M E M O R A N D U M

EUGENE WATER & ELECTRIC BOARD
GENERAL MANAGER'S OFFICE

Rely on us.

TO: Commissioners Simpson, Brown, Cassidy, Ernst and Cunningham

FROM: Roger Gray, General Manager

DATE: April 5, 2012

SUBJECT: Advanced Metering Infrastructure (AMI) Business Case

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Issue:

Should EWEB move forward with further detailed planning, positioning the utility for an ultimate deployment of Advanced Metering Infrastructure (AMI)? If so, when and how?

This is the AMI business case for EWEB. It will be supplemented by a presentation and discussion at the April 17, 2012 Board meeting. Delivery of this business case fulfills an important step. The AMI decision is a critical strategic decision for EWEB. We are at an important crossroads for our energy and water future. We face the same traditional utility challenges that we have for the past 100 years, and we also face new emerging challenges. A decision to move forward (or not) with AMI will open or close future opportunities for EWEB and our customers. EWEB has evaluated AMI (and AMR) for many years. Management believes we have sufficient information to make a clear recommendation to the Board on general direction and next steps.

Executive Summary and High Level Recommendation:

Management recommends that EWEB move AMI forward to the detailed planning phase based on what we call "Alternative 3." There are many pieces of additional work that are necessary to complete the detailed planning work including further public/customer outreach and engagement.

As further described and supported in this business case, Management recommends that EWEB deploy AMI for both the electric and water utilities with implementation beginning between 2013 and 2015 (which is one to three years later than recent updates). The primary reasons for this later schedule are: (i) to incorporate the customer facing features that Management recommends including in the AMI project, (ii) to fully implement and complete other IT business systems in front of the AMI project and (iii) to continue the demonstration project and public/customer awareness, engagement and education to help make AMI implementation successful.

Due both to cost factors and the fact that Management seeks to provide customers with the full array of benefits that a more complete AMI system for both the Electric and Water Utility affords, we recommend a radio frequency (RF) based AMI solution. Other options for AMI were considered and are also addressed in this business case. In terms of financing AMI, this business case discusses options, but Management recommends that a final decision on financing be deferred to this summer when all major projects and reserve needs can be considered by the Board in a comprehensive way.

The detailed recommendations for the AMI effort are in the section entitled *"Detailed Recommendations and Next Steps"* at the end of the main business case write up (before the appendices).

<u>Background:</u>

EWEB has been evaluating AMI (and its earlier rendition, AMR) for about a decade. Some members of the community feel that EWEB is moving too fast on AMI in spite of the fact that both AMI and AMR have been under careful consideration for years and much of the utility industry, including local utilities, has already moved forward with AMI. Early evaluations of AMI really were considerations of AMR. AMR (Automated Meter Reading) was initially intended only to replace the traditional meter reading function. AMR has been deployed around the nation for well over a decade.

Local examples of AMR include NW Natural's use of remote read gas meters on more than 30,000 homes in the Eugene area. AMR is a "one-way" read-only radio frequency (RF) based communication system meaning it transmits meter reads and that's all it really does. AMI is a "two-way" communication system that takes meter reads like an AMR system does, but also can send messages to the meter to perform functions like: (i) stop and start service ("connect/disconnect" in EWEB terminology), (ii) communicate usage and billing information directly to the customer (via the Home Area Network (HAN)) and (iii) manage or adjust customer side devices such as thermostats (again via the HAN if included). It is important to note that certain advanced services such as remote stop/start service and communication with-in-home devices are available for the Electric Utility and not the Water Utility. Appendix 1 provides a high level overview of an AMI system based on what is recommended for detailed planning by Management in this business case.

AMI emerged as a fundamental improvement and replacement to AMR in about the mid 2000s. In 2007, a critical year for AMI, many standard features were established when some of the nation's largest utilities and manufacturers established designs and performance standards. Many manufacturers, including those under consideration by EWEB are on version 2, 3 and even 4 of this technology.

Utilities self reported to the Energy Information Administration that as of the end of 2010, 48 million AMR and 20 million AMI meters have been deployed in the United States. Based on announced projects and projects in implementation, we believe these numbers will increase substantially each year. While AMI may be new to community members in Eugene, in the perspective of utility trends, EWEB is not an "early mover" on AMI.

At the March 23, 2010 Board Retreat, the EWEB Board discussed the status of AMI in the industry and potential deployment options for EWEB. The direction from the Board at that time was to continue examining AMI opportunities and to further refine the business case. It is important to note that the general view of AMI at that time was that EWEB's AMI system would largely automate two specific EWEB business processes: (1) meter reading and (2) the start/stop function for electric service. At that time, the power resource, grid management, customer facing benefits and other potential benefits of AMI had not been fully understood or quantified by EWEB.

Now, two years later, EWEB has a much better sense of these other 'beyond the meter' benefits. These are quantified and discussed in this business case along with the original meter reading and start/stop benefits. Many business cases by utilities around the nation consider both the benefits of meter reading automation as well as the power resource, grid management and other customer facing benefits.

In the past two years, Management has briefed the Board on AMI and asked for general direction and input. The Board suggested alternatives and options during those briefings. This business case evaluates costs and benefits on a comprehensive basis and considers several alternatives including those requested by the Board.

A final piece of critical background information is that EWEB has completed a comprehensive update to its Integrated Electric Resource Plan (IERP) since the 2010 Board discussion on AMI. This important step was completed in 2011 and formally approved by the Board. EWEB's IERP significantly favors a combination of energy efficiency (EE) (aka "conservation") and customer adoption of demand response (DR) or demand management (DM) programs to meet future resource needs.

Traditional energy efficiency programs which rely on technology and equipment upgrades to save energy are something EWEB has decades of experience with and are really nothing new from a strategic or operational standpoint. Continued progress in gaining more conservation savings means that EWEB is moving into "higher hanging fruit" and we may need to send more defined price signals and possibly refine how we think about utility products and services.

The utility industry is moving to include "behavior-based" EE programs to the portfolio of current customer offerings, which rely on information to help customers make more informed choices about when and how much energy they consume. Demand Management or Demand Response (DM or DR), with its attention on the 'when' component of energy consumption, is a potential game-changer. DM/DR is an important part of EWEB's Integrated Electric Resource Plan (IERP). While EWEB's energy supply portfolio is robust, there is some concern that during a very high peak demand in the future, we could find ourselves short of the energy or capacity we would need to meet customer demand. The traditional means to meet short periods of high demand was for the industry to build 'peaking' capacity plants that often run on fossil fuels. The IERP recognizes a fundamental alternative to building peaking capacity and that is DR/DM. For this reason, a key strategy in the 2011 IERP is to explore the option of a partnership with customers to move load around to manage total resources.

This would represent a fundamental shift in EWEB's business model: from one where utility resources are dispatched to meet an uncontrollable and only partially predictable customer load (with variability based on factors like time of day and weather), to one where customer loads could be "dispatched" to meet the availability of intermittent resources like wind and solar. In order to successfully move to this new paradigm, EWEB will need to utilize technology to meet customer needs and requirements. From a customer perspective, the changing business model requires a shift from being a "passive ratepayer" to an "active participant" in creating the community's power (and water) future. AMI is the critical technology in this new relationship.

Discussion:

Implementation of AMI represents a critical decision for our energy future. There are many factors to consider including traditional economic and financial factors, but also important public, community and customer issues. This business case addresses all of these factors using a combination of quantitative and qualitative analysis and evaluation.

To put the AMI decision in an appropriate perspective, it is important to consider what happens if EWEB does nothing regarding AMI. A decision to "do nothing" does not mean that nothing happens. "Doing nothing" means accepting the status quo which in and of itself, is a decision. It is equally important to understand that the decision to do nothing carries significant risk and cost.

In 2010 and in more recent updates, EWEB Management has presented the Board with AMI project cost estimates. Typical ranges of upfront capital project costs have been estimated at between $27 and $33 million. This range varied not because we lacked confidence in our ability to estimate, but because the system scope was not yet determined. The scope under consideration varied from a basic meter reading system to a more fully functional advanced AMI system. Since then, EWEB has completed more detailed analyses and has actually conducted a RFP process to validate our project cost estimates.

Management believes that focusing solely on project costs does not adequately reveal what this decision is really all about. The 2010 presentation indicated that a basic AMI system (one that only did meter reading and start/stop service) had a potential positive benefit. This business case is more detailed and shows that moving forward with AMI and whether it makes financial sense or not depends, in large part, on the additional options chosen. To put the decision in proper perspective, Management believes we must first carefully evaluate the "business-as-usual" approach. Business-as-usual is what we forecast will occur absent a decision to implement AMI.

For example, even without AMI, EWEB will need to update its meter inventory and will be using digital, not analog, meters as we replace the electric meter plant. In addition, we assume an overall acceleration of meter replacement; both the Electric and Water Utilities have deferred the meter change-out process while examining an AMI implementation. This non-AMI Alternative is called the "Base Case" for purposes of the financial analysis.

As part of the AMI business case development, Management also standardized EWEB's financial analysis tools. This effort was lead by the CFO and the finance organization and

included outside consulting. In the past, EWEB used different tools, methodologies and even assumptions to make different business decisions. Standardizing tools, methodologies and assumptions is considered a best practice and EWEB has now adopted this approach. The new approach is documented and even includes internal controls and processes to update assumptions which will change from time-to-time. This AMI business case follows the new approach and other important decisions such as Carmen-Smith relicensing will also use the new approach.

To summarize, the AMI business case presented in this material, compares three AMI implementation alternatives to a non-AMI (the Base Case) alternative which we consider the "business as usual" Alternative. All Alternatives are evaluated over a 20-year period. In addition to the financial aspects of the analysis, this business case also evaluates other non-financial factors.

Base Case and Alternatives:

In preparing this Business Case, Management evaluated a Base Case and three possible AMI alternatives. As described above, Management has run these options through standardized analysis, assuming a 20-year evaluation period in all cases. Management believes it is appropriate to look at a 20-year view rather than simply looking at one-time project costs, in order to capture the many complexities of the decision and provide an adequate view of future impacts. The following sections provide a short description of each Alternative.

Base Case:

EWEB must manage and replace its electric and water meters on an on-going basis whether AMI is adopted or not. The Base Case assumes that EWEB's processes and practices stay more or less the same: meter readers in the field and field service representatives doing truck rolls to start/stop service. However, the Base Case does not assume that our meter replacement practices stay the same.

For example, EWEB has been using both non-communicating and communicating digital meters at the residential level for many years now. These are neither AMI meters nor are they the traditional "under glass" analog meters. The Base Case assumes that going forward, digital meters will be used and that these meters also have a 15 year life similar to that assumed for digital AMI meters. The Water Utility also intends to replace water meter bodies on a more frequent basis than in the past. The new water and electric CIPs will reflect this change. The basic reason for accelerating meter replacement (AMI or not) is the increased cost of power and water relative to metering costs. The days where power and water in the Northwest were almost "too cheap to meter" are long gone; meter accuracy is critically important. Appendix 2 contains a summary of the major assumptions including meter change-out practices.

Alternative 1: (Basic AMI—Electric Only)

Alternative 1 assumes implementation of AMI for the Electric Utility only. Management and replacement of water meters in Alternative 1 is identical to the Base Case. In Alternative 1, the AMI system is only deployed for the Electric Utility and it is limited to a basic system that performs two basic core business functions: meter reading and start/stop service. It is important to note that water meter reading costs increase substantially in this Alternative 1. In the Base Case, meter reading costs (electric and water) are split 82/18 with the Electric Utility paying 82% of meter reading costs. The 82/18 split is based on a study of total overheads; the actual costs attributed to either utility for individual costs, differs. Meter reading is a cost category where the 82/18 split actually benefits the Water Utility. In Alternative 1, only water meters are read in the traditional fashion. Therefore, AMI costs are assigned to the Electric Utility and meter reading costs are assigned to the Water Utility. While it would take fewer meter readers overall for Alternative 1, there would still be substantially more than the Water Utility currently pays for because of the lost labor efficiency that results from only reading water meters.

Per the Board's request, Management also considered non-RF (radio frequency) options for AMI in Alternative 1. Some community members and customers have also suggested that EWEB consider non-RF options for AMI. Non-RF options include "wireline" options such as power line carrier (PLC), telephone lines or direct fiber connections. It turns out that wireline options are far more costly to implement and have limits to overall functionality, such that no vendors that responded to EWEB's RFP offered wireline solutions as part of their proposal. As a result, Alternative 1 costs are based on the RF option for which EWEB has RFP response quality cost estimates. Still, this alternative provides a best case starting point for non-RF options. If EWEB did pursue a non-RF option for AMI, we could only do AMI for electric meters since there would be no reasonable or technically practical way to reach water meters (there is no wireline connection). Therefore, Alternative 1 is a proxy for a non-RF AMI future. A true non-RF option would actually be more expensive. The implications of this are discussed more thoroughly in Appendix 3, entitled "Non-RF AMI Options".

Alternative 2 (Basic AMI—Electric and Water):

In Alternative 2, AMI is deployed similarly for the Electric Utility as in Alternative 1, but AMI is also deployed for the Water Utility. Like Alternative 1, the AMI system is limited to a basic system that performs two primary business functions (meter reading and start/stop service for electric). Alternative 2 looks better from a financial perspective since there are greater cost savings from the elimination of manual meter reading across both utilities. In Alternative 2, an RF option is required to communicate with the water meters. While it is theoretically possible to reach water meters through a non-RF option it is not economically or technically practical. Therefore, a non-RF option for Alternative 2 was not considered.

Alternative 3 (Advanced AMI--Electric and Basic AMI--Water):

Alternative 3 builds off of Alternative 2 by adding both the costs and benefits of a more robust and advanced AMI system that can provide power resource benefits, grid management benefits and other customer facing benefits. The cost of such a system compared to Alternative 1 or 2

would be higher, but so would the potential benefits. In the expected case, the additional benefits exceed the additional cost. Consistent with Alternative 2, the analysis assumes replacement of water meters and an RF-based AMI system both to communicate with the water meters and to provide the value-added customer benefits reflected in this alternative.

Table 1 below is a summary and comparison of the major assumptions and basic system features of the Base Case and three Alternatives:

Table 1: Summary of Major Assumptions and Basic System Features:

Description or Assumption	**Base Case**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Short Description	Basically Status Quo for meter reading and updates to how meter plant is managed	Basic Electric Utility AMI for meter reading and start/stop service only. No Water Utility AMI	Basic AMI for Electric and Water utilities for meter reading and start/stop service.	Basic AMI for Electric and Water utilities for meter reading and start/stop service plus advanced AMI for power resource benefits, grid management and customer facing benefits.
Analysis Period	20 years	20 years	20 years	20 years
AMI system	No	Electric only. Basic AMI system	Electric and Water. Basic AMI system	Electric and Water. More advanced AMI system.
Home Area Network card included?	n/a	No	No	Yes
Meter Reading	Same as today	Electric: AMI Water: Same as Base Case	Electric and Water: AMI	Electric and Water: AMI
Start/Stop service	Same as today	Electric: AMI Water: Same as base case	Electric: Yes Water: Same as base case	Electric: Yes Water: AMI Same as base case
Meter Data Management System to enable additional benefits	No	No	No	Yes
Customer facing options such as (i) pre-pay, (ii) web-portal, (iii) home energy display and (iv) other customer facing programs	No	No	No	Yes

Enables future programs	No	No	No	Yes
Can handle new rate structures such as TOU	No	No, unless later investments are made.	No, unless later investments are made.	Yes, including real-time information.
Potential for real-time information	No	Limited	Limited	Yes
Water Leak detection capabilities	No	No	Maybe, but would require additional investment	Yes, with additional investments
Potential platform for advanced grid management and "smart grid"	No	No	No	Yes, with additional investments
Supports IERP strategies for additional EE and new DM/DM programs	No	Maybe, would require significant additional investment	Maybe, would require significant additional investment	Yes, with additional investments
RF or non-RF based AMI	n/a	Analysis assumes RF-based (least cost). Electric only could be non-RF based, but would be more expensive	RF-based	RF-based
Meter life/ replacement cycle	15 years	15 years	15 years	15 years

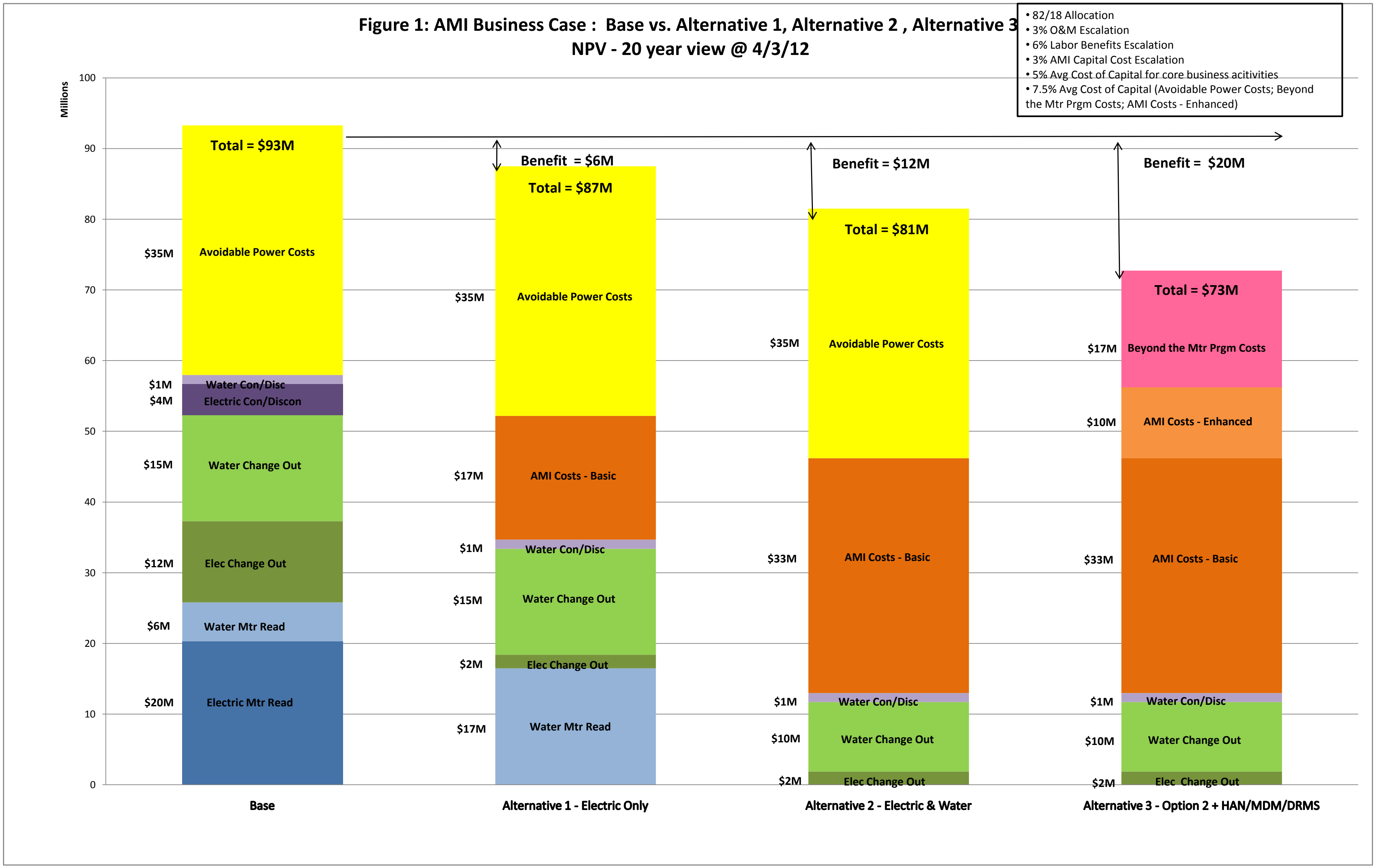
<u>Summary of Base Case and Alternatives Financial Results:</u>

The financial results of the Base Case and Alternatives 1 through 3 are summarized and depicted in Figure 1 below. The business case analysis is presented on a "Net Present Value" (NPV) basis. NPV is a standard method used to assess the value of an investment. Future benefits are discounted back to the present to evaluate whether an upfront investment makes sense. NPV analysis is particularly helpful when evaluating and comparing alternatives. The Base Case reflects a summary of all costs that are expected to be incurred over a 20-year period. Compared against the Base Case, the three alternatives summarize the expected cost and benefits (or avoided cost) over the same 20-year period. This allows for an apples-to-apples comparison of the options. For example, Alternative 1 shows higher meter costs for electric (to install AMI) over a 20 year period, but, as one would expect, lower meter reading costs due to the fact that electric AMI replaced meter reading. Because Alternative 1 includes AMI for electric only, the

financial analysis shows that water meter reading costs go up relative to the Base Case since the Water Utility would no longer benefit from shared meter reading costs with the Electric Utility.

It is important to note that the NPV summary is based on both the Water and Electric Utility economics together. The relative impacts to each utility can be different, but the combined impact can still be positive. For example, Alternative 1 shows an NPV better than the Base Case (lower NPV); however, each utility is different in terms of result. The Electric Utility is better off and the Water Utility is worse off mainly because meter reading costs for the Water Utility go up. The net result of the two utilities, however, is still good and from a combined customer perspective, customers are better off.

Figure 1: Economic Analysis of Base Case and Alterntives 1, 2, and 3 (Note: Lower NPV or lifetime cost is better)



As shown in Figure 1, the 20-year expected lifetime cost associated with the Base Case is $93 million. This is the amount of money EWEB can expect to spend by staying with its current metering strategy. Again, Management believes this is the proper perspective to take when evaluating AMI options rather than simply looking at the one-time AMI project costs. Importantly, our analysis assumes a 15-year meter life, which results in the beginning of a second meter replacement cycle at year 15. Other parts of the AMI system (such as IT servers) are assumed to be replaced more frequently (on a 5-year basis for the servers). Using a 20-year business case helps assure the best long-term perspective for all options considered.

Alternative 1 (basic AMI for electric only) shows an expected cost of $87 million (a $6 million benefit over the Base Case) over the same 20-year period. Again, this is based on an RF-based solution. If EWEB were to go electric only using a non-RF AMI solution, the cost would be more. This is discussed in more detail in Appendix 3: "Non-RF AMI Options". What Alternative 1 shows is that electric only AMI is more economic over a 20-year period than the Base Case assuming an RF-based AMI solution. However, from a project risk and TBL perspective, it may not be worth pursuing Alternative 1. The AMI implementation would require significant customer education relative to the somewhat limited customer benefits generated. Exploring non-RF options for Alternative 1 would substantially reduce the potential benefits and in some cases the benefits would be negative (meaning there is not a business case justification).

Alternative 2 (basic AMI for both electric and water) shows an expected cost of $81 million (a $12 million benefit) over the same 20-year period. Because water is part of the AMI deployment, Alternative 2 assumes an RF-based solution. What Alternative 2 shows is that electric and water AMI is more economic than both the Base Case and Alternative 1. The basic conclusion here is that AMI makes more sense if it is done for both utilities, if it is going to be done at all.

Alternative 3 (Alternative 2 plus more advanced AMI options) shows an expected cost of $73 million (a $20 million benefit) over the same 20-year period. This is also based on an RF AMI solution. Alternative 3 assumes a more significant AMI investment upfront with the single largest additional investment being a Meter Data Management (MDM) system. This investment is necessary to implement more of the customer facing programs and to enable power resource benefits and grid management benefits. It is important to note that Alternative 3 graphs represent the expected outcome while the analysis considered a range of possible outcomes. This is because the cost/benefits for the Base Case, Alternatives 1, 2 and part of 3, are largely firm and well understood while the benefits associated with the more robust features of an advanced AMI have a wider range of uncertainty. This is the same process of considering a range of outcomes that the Board saw with the last Carmen-Smith financial case update. Uncertainty about future prices in the wholesale market translates into uncertainty in future project benefits. Another factor that adds to the overall uncertainty is the range of customer participation rates assumed for future energy efficiency/demand side management/demand response options. Management assumes and recommends that these programs be voluntary "opt-in" programs rather than mandatory programs; the speed with which they are embraced by the community is uncertain and there is a range of assumptions about participation.

General Financial Conclusions:

Based on the financial analysis of the Base Case and Alternatives 1, 2 and 3, the following general conclusions can be drawn:

- The Base Case is the most expensive option over a 20-year period.
- Alternatives 2 and 3 provide better financial value and opportunity for EWEB customers.
- Alternative 1 (basic electric AMI) is somewhat more economic than the Base Case. Again this assumes an RF-based option and a non-RF option (discussed in the next section) would be more expensive than the Base Case
- Alternative 2 (basic electric and water AMI) is better than both Alternative 1 and the Base Case. This conclusion is consistent with the results from the 2010 analysis and we have confirmed that our 2010 numbers were solid and have been supported by more detailed work and RFP results.
- Alternative 3 (basic electric and water AMI plus more advanced electric AMI) is the strongest financially and even with a range of uncertainty around the potential resource benefits it has the most potential promise.

Based solely on the financial analysis, Alternative 3 is the best case to pursue. However, a complete business case must consider other factors. These additional factors are addressed in the sections that follow.

Other Business Case Considerations and Board Questions and Requests:

Non-RF AMI Options:

The Board asked Management to investigate non-RF AMI options. Because we are a combined Electric and Water Utility, EWEB was only pursuing AMI systems that could handle both electric and water needs. We had extensive and reliable data on the costs associated with RF options (e.g. RFP responses) so we are confident in the RF-based costs. The primary implication of pursuing a non-RF AMI option is that water meters cannot be reached economically or in any technically practical fashion. An additional factor is that some advanced metering options rely on wireless technology to transmit information within the customer home. Therefore, Management concludes that non-RF AMI options are not economically or practically feasible and recommends against further consideration of non-RF AMI options. The non-RF AMI options are discussed further in Appendix 3.

"AMI Light" Option:

The Board inquired about a possibility of a "lighter" version or alternative to current AMI technology that relies on a different approach perhaps using less technology and basic simple devices such as timers to "control" appliances.

Management concludes that such an approach while conceptually appealing would not provide the expected benefits of a full scale true AMI system. The "AMI Light" option is discussed further in Appendix 4.

Risks and Public Considerations/ Concerns:

There are a variety of general and specific risks associated with implementation of AMI or any major technology project. Management has considered these general and specific risks and concluded that while they represent valid concerns, most can be reasonably addressed, eliminated or mitigated in a variety of ways. Management recommends that these risks be further addressed in the detailed planning phase and as described in both Appendix 5 (Risks and Public Considerations and Concerns) and the sections that follow below. A variety of important public considerations and concerns are also considered and addressed in Appendix 5.

Opt-in and Opt-out:

"Opt-Out" of AMI Meters:

Management recommends that any EWEB AMI deployment permit an "opt-out" option for the reasons provided in Appendix 5. Other utilities and regulatory commissions have provided this option and Management believes that this is a reasonable approach. In providing an opt-out option, Management believes that certain issues must be addressed upfront. The main opt-out issue that must be addressed is recovery of added cost. Management expects that a very small number of customers would actually opt-out of AMI meter installation. It is likely that these customers will be somewhat randomly distributed throughout the service territory. Unlike meter reading today which is fairly efficient due to route structure, it is expected that the cost of manually reading non-AMI meters would be substantially higher in a post AMI utility. Additionally, EWEB will have to create and maintain completely separate business processes to accommodate an opt-out option. As a general rule, EWEB uses cost of service principles to assign costs and develop rates for various customer classes. Management recommends that a separate opt-out tariff be developed for opt-out customers. The final cost estimates for managing an opt-out tariff would depend on the final number of customers that opt-out. The other major issue that would need to be addressed is the type of meters installed at an opt-out location.

As explained in earlier sections, EWEB began to move from analog to digital meters many years ago. It is possible that EWEB will ultimately move to more complex rate structures such as Time of Use (TOU) rates. Meters (communicating or not) would need to have the capacity to store more data. It is possible that opt-out customers will have either digital non-communicating meters or an AMI meter where the radios are turned off. Management does not believe it is reasonable for a customer to require a particular kind of meter be installed at their site. The opt-out option would merely allow a customer to request that their meter not transmit wireless data, whether for perceived safety or security reasons.

"Opt-in" to Other Customer Facing Programs and Proposed Approach to Customer-side Options:

As discussed in Appendix 5 in the privacy and control sections, there is a great deal of general misunderstanding surrounding AMI meters and their capabilities. At a basic level, AMI meters can perform two primary utility functions: meter reading and start/stop service. However, AMI meters (combined with other advanced AMI technology investments) can enable an entire new

set of utility products and services that will help customers and the utility control and manage future costs. Examples of these capabilities are EV (electric vehicle) charging management, water heater energy management, thermostat remote control, other appliance energy management, and perhaps one of the potentially most powerful customer tools: pre-pay or pay-as-you go programs.

Management recommends that all of these various options be simply that - options. The Alternative 3 business case does not assume any mandatory participation by customers in these kinds of programs. Instead, Management recommends that EWEB's approach to customer facing programs is to make them attractive and understandable so a customer can opt-in at their discretion. Management believes that creation of several customer facing programs (perhaps starting with one to three options) and having a subscription approach to participation will be much more effective in the long-run than creating mandatory one-size-fits-all programs.

This proposed change in EWEB's business model and the resulting customer-utility relationship is based on a working assumption that customers will, if given a choice, prefer having options in the way their utility products are priced, delivered and paid for. For example, some customers may be willing to curtail their load for a price discount. Other customer may not be able or willing to reduce loads, even with a price signal or incentive. AMI meters, coupled with new utility programs and rate structures would enable an energy (and water) future where customers have choices. The importance of customer choice is illustrated by the following electric vehicle example. Some customers may want the flexibility to plug in their vehicle at any time of day and have it charge immediately in real-time. EWEB would see this as normal power consumption that would be subject to normal tariff provisions. Other customers may be willing to "opt-in" to a program that provides a discounted rate or end of month credit, by allowing the utility to manage (within established parameters) when the vehicle is charged. A robust program might allow customers to override the discount option temporarily (e.g. if they needed an immediate charge) and have consumption charged at the normal tariff. Again, Alternative 3 assumes that EWEB designs these programs over time and in collaboration with customers, providing program options with mutual benefits.

Public Participation and Public Issues:

To date, EWEB has conducted some limited public participation efforts. Our goal has been to strike an appropriate balance between taking a "fully baked cake" to customers without opportunity for input, and taking them raw ingredients without any type of recipe. The context and background around EWEB's AMR/AMI exploration are critical in evaluating the current business case. Despite some comments that EWEB is "fast-tracking" AMI, history shows that we have been slowly evaluating AMR and AMI for about 10 years. We have conducted some limited external public outreach, focus groups, customer surveys and other forms of community input. We have been following community outreach and response efforts of other municipal utilities. EWEB has largely been in an "inform and answer" mode rather than a full blown public engagement process. This is in part because we have not had a formal or definitive direction up to this point.

In 2011, EWEB began an AMI demonstration project with a combination of Board members, employee and general customer volunteers. There are about 100 total customer participants in the demonstration project. EWEB is working with University of Oregon researchers to better understand and assess how customers relate to and experience different AMI technologies. Unlike early industry "AMI pilot projects" that were intended to test the actual AMI technology, EWEB's demonstration project is not about proving technological feasibility. Instead it is focused on customer experience and interaction with the technology. We continue to learn from this research and plan to extend the demonstration projects if the Board directs Management to pursue detailed planning for AMI. Our hope is to use what we learn to better design programs to support the Management recommendation - Alternative 3. The demonstration project was never designed or intended to be a statistically valid representation of customer preferences. It was intended to be limited early engagement project to help EWEB better understand the customer experience with AMI. Ultimately, these early learnings will help us develop the next level of public engagement based on the Board's recommended alternative.

In addition to the demonstration project, EWEB has had opportunities to test awareness and support for AMI technology using a combination of statistically valid survey questions as well as focus groups. The survey data to date indicates a general lack of awareness about "smart meters". We've found that there is a small group of people who seem opposed to AMI meters and there appears to be a small group of strong supporters. In spite of the general lack of awareness, there are large neutral and positive support groups. Table 2 below provides a summary of the 2011 survey results.

Table 2: Summary of Survey Results:

Question 9: How familiar are you with smart meters?

Familiarity with smart meters is low, with just over one-third of respondents considering themselves "Very familiar" or "Somewhat familiar" with smart meters. This is well below the critical 50% threshold for familiarity necessary for issue salience.

Total familiar	**36%**
Very familiar	10%
Somewhat familiar	26%
Total unfamiliar	**63%**
Somewhat unfamiliar	13%
Very unfamiliar	49%
Don't know	**1%**

Question 10: Do you have a favorable or unfavorable opinion of EWEB's plan to install smart meters?

Favorability of a plan to install smart meters was high, with 55% of respondents favoring the plan; above the minimum 50% threshold for favorability, but is well below the long-term goal of a 2-to-1 favorability ratio that would be reached with a 67% favorability rating. The large number of "don't know" responses reflects a low level of information about smart meters.

Total favorable	**55%**
Strongly favorable	22%
Somewhat favorable	20%
Lean favorable	14%
Don't know	**28%**
Total unfavorable	**17%**
Lean unfavorable	3%
Somewhat unfavorable	7%
Strongly unfavorable	7%

These types of survey questions are useful for gathering baseline information. The ongoing demonstration project will build on this knowledge and help EWEB develop a more comprehensive communication strategy. Using the cake analogy, we believe that the approach to date has struck the right balance between taking a fully baked cake and raw materials without a recipe. EWEB will begin to ramp up public awareness and expand the public participation process once the Board has provided direction following discussion of this business case.

Implementing Alternative 1 or 2 would largely involve changing internal EWEB operations and would not necessarily generate any specific customer facing changes. Because Management is recommending more detailed planning for Alternative 3 which ultimately has more customer facing programs and options, it is important to continue to build awareness and education around the capabilities of AMI meters. Alternative 3 fundamentally supports EWEB's adopted IERP strategy to develop enhanced customer participation and partnership to better manage energy resources.

This new business model will require awareness and education not only about AMI meters, but also about the importance of customer choices in determining their energy future. Management recommends that EWEB expand and continue the demonstration project and start to expand the public awareness and education process if the Board approves a specific AMI direction. The awareness and education process will look very different for Alternative 3 versus either Alternative 1 or 2.

Another community issue relates to River Road and Santa Clara Water Districts (Districts). While the Districts are independent agencies, EWEB provides the majority of administrative and operational services, including meter reading and stop/start. EWEB's implementation of AMI will impact the Districts. Management has engaged in ongoing dialogue about our investigation of AMI and possible future plans. Ultimately, the Districts will have to determine their own technology and business practice decisions, as well as rate impacts to their customers. It is possible that the Districts could invest in the same AMI meters and technology as EWEB and EWEB could continue to provide meter reading services to the districts via AMI. Another option is that EWEB could continue providing traditional meter reading services to the Districts although it is likely that those services would be more expensive. A third option has the Districts

employing their own meter readers and investing in the systems necessary to manage this function. While this is certainly an important issue for the community at large, Management believes that the Water Districts have reasonable options and we recommend continuing to offer options for new services if it makes mutual sense to do so.

Other Electric Utility Benefits:

AMI meters combined with other tools and systems generally called "smart grid" will also provide other utility and customer benefits that are not included in the economics of this AMI business case. While the value provided is generally considered "soft" or more difficult to quantify, they are nonetheless important benefits to consider as part of this evaluation.

Outage Detection and Restoration:

Generally speaking, electric distribution system outages can go undetected by the utility for those parts of the system that are not monitored with SCADA (supervisory control and data acquisition). If EWEB loses a distribution feeder that causes a monitored breaker to open at a substation we know immediately that all customers on that feeder are out of power. However, there any many things "downstream" on that feeder that are not monitored. Therefore, customers can experience an outage that in many cases EWEB will not "see" until a customer calls us to report the outage. AMI meters can serve as part of a much more robust outage reporting system because the AMI meters can communicate their status with the central control system. Utilities that have installed AMI state that outage detection is faster with AMI in place and that troubleshooting and restoration are also faster and more effective because the system can help narrow down outage locations rather than requiring human patrolling of a distribution circuit to find the cause of an outage. This is clearly a customer benefit, but it is more qualitative in nature than quantitative.

A very real example of this situation is the recent March 21, 2012 snowstorm where EWEB experienced about 9,000 customer outages (about 10% of our electric customers). Our current system gives EWEB very little insight in to the location and nature of outages. We rely on customers calling in outage and downed wire reports. EWEB then must patrol miles and miles of lines to troubleshoot and locate problems. While it would still take crews to make physical repairs to downed wire and broken poles, AMI meters would help in the outage location, assessment and restoration processes because it would automate with technology what is currently done with phone calls, truck rolls and lengthy delays. Our neighboring utility, Lane Electric Cooperative, has shared and shown us how they use their AMI system to improve customer service and information availability. Their experience is very consistent with other utilities. The value of this added reliability and faster restoration time is not included in the business case.

Improving System Design and Management:

AMI meters will also provide much better information to utility system operators and engineers on system performance and efficiency. For example, circuits can be better balanced and managed as more monitoring points are put in to the distribution system. Equipment can be

sized with more accurate and dynamic information rather than static assumptions. Management believes that these enhancements ultimately will result in hard savings, but the financial benefits have not been included in the business case. Examples of these potential benefits include optimizing equipment sizing and balancing phase/load to reduce power loses.

Different Utility Products and Services and Our Power Future:

The 20^{th} century Electric Utility model was largely built around the concept of a single highly standardized product. Meters were not able to differentiate product attributes therefore utilities only sold one basic product. Meters measured kWh delivered and there was a price for that standardized product. The ability to differentiate the product was limited by the both the meter and the relative lack of value discernable product attributes.

Fast forward to the 21^{st} century model and much is changing. As resources become more constrained and expensive, the management of such resources becomes more critical to a utility's success and it only makes sense to differentiate the product so that it is consumed wisely. AMI meters permit utilities to better manage the utility system by differentiating products and services. Some of the power a customer consumes must be delivered at the exact time that the customer wants it (e.g. power to create the light you want right now). However, some power is used to produce something that you might "consume" at a different time (e.g. power to charge your EV or power to heat your hot water). The 20^{th} century model did not differentiate these products and services, but a 21st century model can. Achieving EWEB's strategic vision will depend to a great deal on our ability to adopt such new capability.
AMI meters are an important component of jumping to a 21^{st} century model and being able to achieve EWEB's IERP strategy of avoiding expensive, carbon-intensive power to meet very temporary spikes in power demand. If we stay with a 20^{th} century model we will continue to build 20^{th} century resources using a 20^{th} century approach. The cost of this model, which artificially disconnects variable market prices from rates, is ever increasing. Management does not believe AMI will reduce rates. What AMI can do is help us all more effectively manage the pace at which rates increase and permit customers to consume resources wisely and efficiently with more options, more control and more choice.

What about the Water Utility?

Much of the discussion about AMI is dominated by the Electric Utility. However, AMI also may create additional benefits for the Water Utility and water customers besides meter reading cost savings. The financial analysis of Alternatives 1, 2 and 3 relative to the Base case shows that Alternative 1, electric implementation only, has the highest 20-year cost over Alternatives 2 and 3. Based on meter readying cost savings alone, it makes financial sense for the Water Utility to participate in the AMI implementation. Alternative 3, the Management recommendation, does not assume or quantify any additional benefits or programs for water customers. However, several potential benefits are discussed in Appendix 6 on a qualitative basis. These benefits have not been included in the business case but they do provide value to EWEB's customers.

Other Potential Community Benefits:

An AMI system implementation at EWEB would rely on a backbone communication and control infrastructure. That infrastructure can be designed and expanded to meet other community needs. None of these other potential community needs and potential benefits is included in this business case. EWEB is just beginning to discuss some of these options with possible partners such as the City of Eugene. Examples of shared systems with City of Eugene might be streetlight and traffic signal outage and maintenance management, irrigation controls for parks and other municipal needs. If the Board approves moving forward, EWEB would initiate discussion with potential partners to explore possible shared used of the communication and control systems to create broader community benefits.

TBL Assessment and Summary:

Like any complex decision or project, AMI meters raise a variety of economic, social and environmental issues. The economic elements of this business case are well quantified and understood. Social and environmental factors have been evaluated on a more qualitative basis due to the very nature of these factors. EWEB formally adopted a TBL (triple bottom line) policy in 2010. The policy requires that all major decisions (like an AMI implementation) are considered against this backdrop and policy. A TBL analysis is not intended to create a clear and obvious decision similar to what an economic analysis using "net present value" methodologies might provide. Instead, it is an assessment of quantitative and qualitative factors and a summary of those factors for policy makers to consider when making decisions. Management has created a TBL assessment and summary in Appendix 7.

Financing and Rate Impacts of AMI:

There are different financing options and rate impacts associated with the Alternatives under consideration, including the Base Case. While the recommended Alternative 3 has the best overall financial impact on customers over the 20 year evaluation period, it can have different short and long-term rate impacts depending on how Alternative 3 is funded. The implications and possible options are discussed in Appendix 8.

Management's conclusion is that over a 20 year period AMI is better for customers than the Base Case. The short-term or immediate impact will depend on how AMI is financed. As demonstrated in Appendix 8, short-term impacts can be neutral, slightly positive or slightly negative relative to status quo. Should the Board decide to move forward with AMI, Management recommends that these options be discussed later when the Board discusses use of reserves in an overall context, since use of unallocated cash is a factor that, in part, influences the possible rate impacts. It is important to note that over the long-term 20-year period, customers are financially better off with AMI regardless of how, or whether, it is financed with debt.

Timing and Relationship to Other Related EWEB Projects:

Because Management recommends that we move into more detailed planning for Alternative 3, we also recommend that AMI implementation be targeted to begin in later 2013 through 2014 or even 2015. There are multiple drivers for our recommended later project initiation including:

- In implementing Alternative 3, we recommend that at least one or two customer facing programs (e.g. pre-pay) are included in the initial rollout. This approach helps customers see value immediately from their investment. However, it is a more complex approach than a standard AMI system and will take extra time to implement.

- EWEB presently does not have an effective "Work and Asset Management" system (WAM). Regardless of whether AMI is implemented or not, WAM is a project that is critical to EWEB's long-term management of the utility. A logical sequencing of projects would be to do WAM first and then AMI. In fact, lack of an effective WAM is a potential risk to AMI implementation. WAM is not a simple project. Initial planning work is just being completed on EWEB's overall Information and Business Systems 5-year plan and the initial recommendation is to begin WAM implementation later this year (Q32012 to early 2014) and AMI later (late 2013 through 2014 or even 2015)

- This schedule would also allow EWEB to conduct additional demonstration project work to better design and choose the optimum customer facing programs to include as part of Alternative 3 implementation.

- This schedule will allow for more public awareness, engagement and education.

- This schedule will allow EWEB to plan a more effective AMI project including developing the customer facing programs contemplated by Alternative 3 and developing details around "opt-out" options that Management also recommends.

- Additional time will permit the water districts to plan their path forward given the Board selected direction.

Detailed Recommendations and Next Steps:

Management does not recommend continued consideration of the Base Case or Alternative 1. Alternative 2 could be a possible back-up plan for Alternative 3.

- EWEB has evaluated AMI for many years and this business case is consistent with the 2010 conclusions and direction; further study is unlikely to yield fundamentally different results while continuing to divert Management attention and resources from other projects.

- If Alternative 1 or 2 were considered, Management would at least recommend that the HAN chip be included in the electric meter to enable a possible future opportunity to pursue Alternative 3. This cost is estimated to be $670,000. If the HAN chip is not

included in the initial implementation and a subsequent decision is made to implement the advanced features and capabilities of Alternative 3, a very expensive meter change out would be required. The value of having that option available in the future makes the upfront investment appropriate regardless of whether Alternative 2 or 3 is selected.

Further, Management recommends that EWEB:

- Not consider AMI technologies that are not justifiable economically, such as fiber or PLC, or non-RF AMI options.

- Continue evaluation and detailed planning of an AMI implementation strategy that focuses on Alternative 3 as the desired outcome. Given the additional complexity of this approach, target meter deployment dates should be extended to a timeframe that allows core business functions and key IT infrastructure work to be in place prior to AMI deployment (possibly 2014)

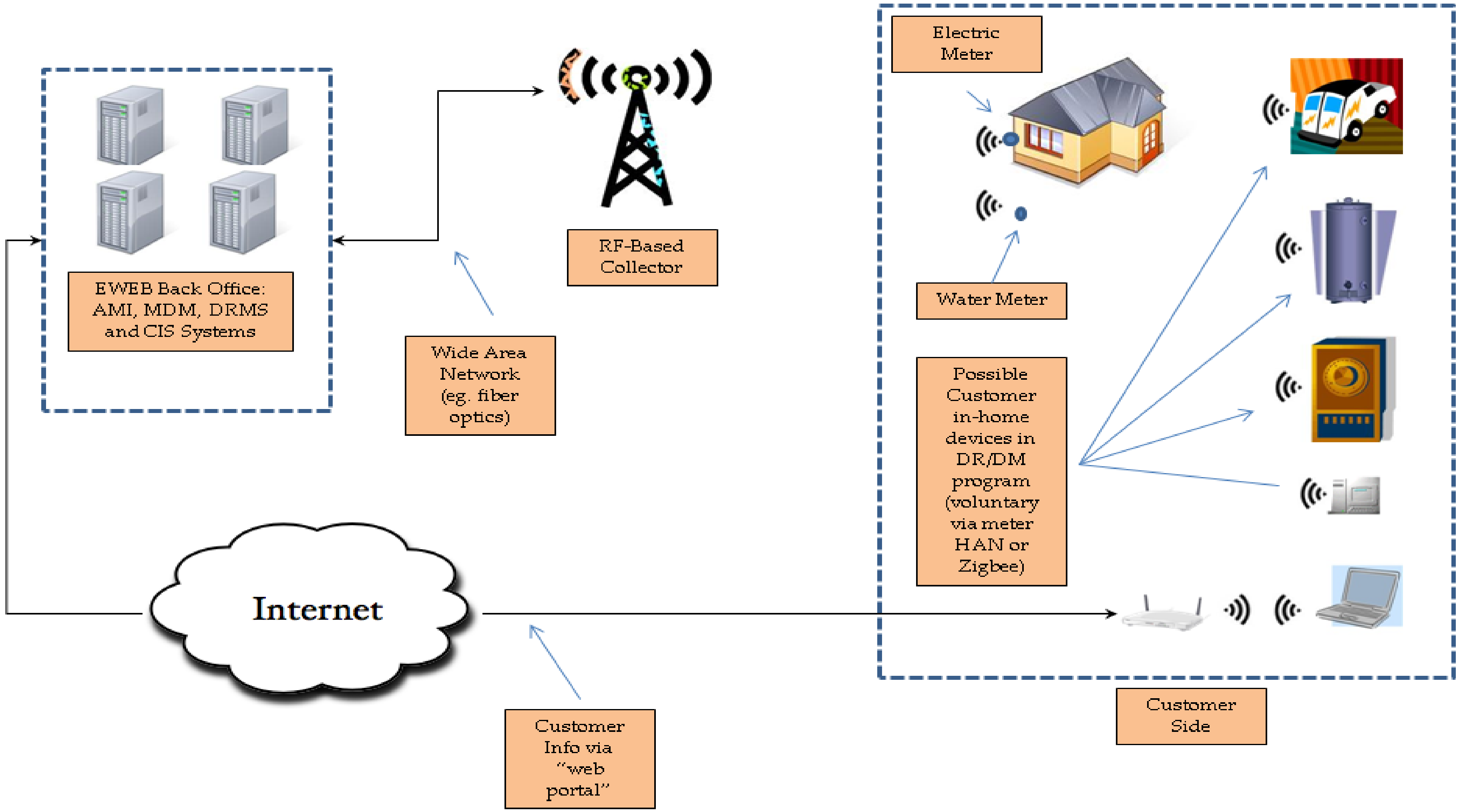
- Expand and extend the current AMI demonstration project (including possible alternative technologies to the existing demonstration project) to assist in both Alternative 3 program design and a validation process related to customer acceptance, expected participation levels and resulting DM/DR benefits

- Continue the current effort and develop an additional focused and expanded public engagement process that involves customers in the design of Alternative 3 including policies and programs such as a "Customer Bill of Rights", a formal opt out policy, and preferred customer facing programs for Board review.
- Plan on financing AMI by using a combination of excess reserves and new debt. Direct Management to present specific financing options by August 31, 2012 as part of the financial planning process.
- Absent approval of specific AMI direction, Management recommends that EWEB stop considering AMI for a period of at least five years and perhaps revisits it at a later time.

Requested Board Action:

Approve Management recommendations listed above or clearly specify an alternative direction.

<u>Appendix 1 AMI Architecture (simplified):</u>



Appendix 2 Summary of Major Assumptions:

AMI Business Case: Assumptions Comparison between 2008, 2010 and 2012 business case versions

	2008	2010	2012
GENERAL			
G1	Target vendors with proven technologies, focused on high likelihood of success in achieving operational savings	No change	No change
G2	Require single AMI vendor to provide water and electric features. One AMI head-end, one network.	Allow bidders to propose separate water and electric AMI systems, but prefer single solution.	No change
G3	Assume one vendor to deliver: • AMI head-end installation • Communications network design and installation • Water and electric meters/modules • Meter change-out (non EWEB) • Critical integration with EWEB IS Systems (AMI to CIS for billable reads; disconnects)	No change	No change
G4	Assume EWEB maintains control over: • Project Management • AMI customer escalation • Some meter installations • Set-asides/go-backs	No change	Added: • Security testing of system
ELECTRIC			
E1	88,827 meters	No change	89,200 – Assume replacement of all but top 30 or so revenue meters (those already on ION)

E2	Prefer maximum memory capability and remote programming/firmware upgrades	No change	No change
E3	83,177 meters; unable to separate switch cost	83,177 meters @ $50 = $4.2M	81,760 meters @ $25 = $2M
E4	1.5% growth of electric meter plant	.9%	.5% (matches LTFP parameter)
E5		Add assumption for .5% of orphaned meters	No change
E6		Assume .5% failure rate	No change
E7		Include cost of HAN gateway in all available meters (83,177 meters @ $25 = $2M)	Include cost of HAN gateway in all available meters (83,620 meters @ $8 = $670K) for Option 3
E8	25 year replacement cycle	No change	15 year replacement cycle
WATER			
W1	Assume module only retrofit of meters less than 20 years, which is 56% of plant.	Changed to 5 years, which is 13% of plant.	Changed to 20 years, which is 66% of plant. Added assumption of digital register retrofits for 99% of those where meter body not replaced.
W2	Assume all other meter bodies are replaced	No change	No change
W3	1.0% growth rate for water meters	No change	.25% (matches LTFP parameter)
W4	Assume 10 year life of battery.	No change	15 year life of battery. Assumes water modules are replaced at battery failure, not just battery, since they are a sealed unit.
W5	50% of meter lids to be replaced	No change	100%
W6	.5% failure rate	No change	No change
W7	Costs for retrofitting Santa Clara and River Road excluded (about 8,000 meters).	No change	No change
W8	Model did not address	Assume 10% of meter boxes will need to be dug out and replaced.	No change
W9	Model did not address	Assume 10% of meters replaced will need plumbing repairs, a service line moved, or other change due to the condition of EWEB's service line or customer side private plumbing.	No change
W10		Identified pricing error in 2008 version of water costs of $50/meter.	No change
W11	35 year replacement cycle	No change	15 year replacement cycle
FINAL			

F1	3.5% inflation on O&M expenses incurred (costs) and avoided (benefits)	1.0% for costs; 1.5% for benefits	3.0% for costs; 6% for benefits
F2	3.5% escalation on AMI capital costs	No change	3%
F3	4.72% weighted average cost of capital	No change	5.0% for core business; additional 2.5% for non-core activities included in Option 3
F4	Include costs savings that represent efficiency gains	Include in model only benefits providing direct cash benefits. • Remove 'parts of FTE' savings • Remove cash flow improvement benefits • Remove meter accuracy benefits • Remove unbilled accounts benefits	No change from 2010
F5	Do not include indeterminate future benefits: • Voltage optimization • Demand Response/Load Control	No change	Included in Option 3
F6	100% Deployment Benefit Lag	80%	75%
F7	86/14 Allocation between Electric and Water	No change	82/18 to match 2013 budget plans
F8			Purchase Spectrum for $675K rather than lease for $50K/20 years
IT/TELEPHONE			
IT1	Assume meter communication network is isolated network using mesh or fixed tower RF. Some consideration may be give to deploying a city wide wireless cloud.		Assume Fixed Tower and no multipurpose wireless
IT2	Assume EWEB fiber for backhaul. No (or limited) capital construction, no monthly fees. There may be some consideration give to a community wide wireless cloud.		No change except that there will not be a multipurpose wireless
IT3	EWEB will own and operate the AMI system	EWEB will evaluate hosting solution for AMI/MDM as potential to reduce project risk and upfront capital investment.	No change from 2010
IT4		5 year capital replacement program for IT gear for on-premise option.	No change

INSTALL			
IN1	Assume outsourcing of all meter replacements except: • Class 200 3 phase and CT related meters (E) • 3” and larger (W) • Go-back (not to exceed 1.5% of plant)	No change	No change
IN2	Assume 24 months full scale roll out with water heavy in winter months and electric heavy in summer months – deploying 80% of meter plant	Moved to 12 months	Remain at 12 months.
NEW SERVICES			
NS1	Eliminate same day fee for start/stop	Remote start/stop services will allow for same day turn on/off at $75 fee	No change from 2010

Appendix 3 Non-RF AMI Options:

Non-RF AMI Options:

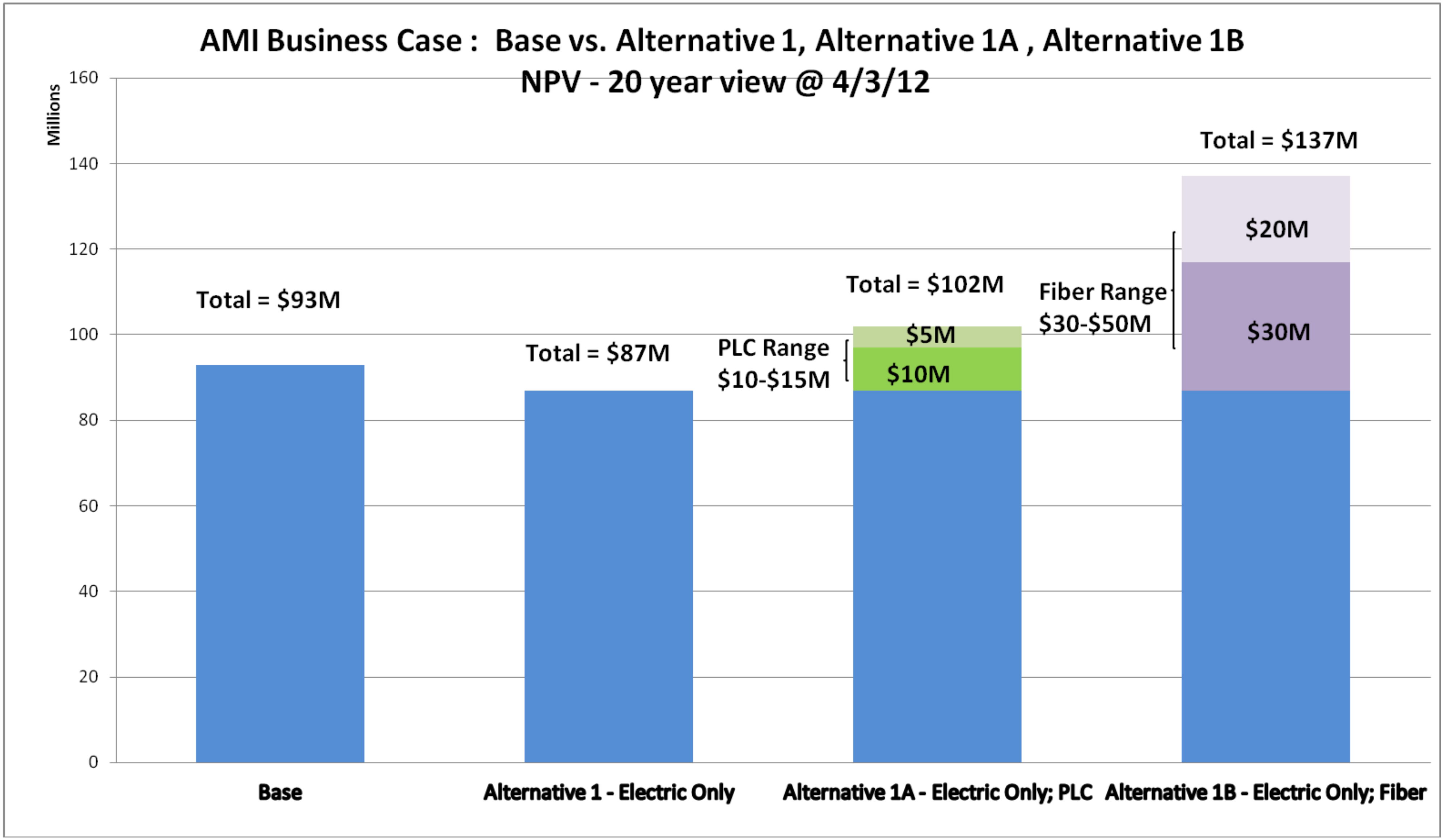
The primary driver of pursuing a non-RF AMI option might be concerns about the potential health impacts of RF. Therefore, Alternative 1 (which again is based on the best case RF costs) actually does not reflect a total non-RF solution. However, to address the request of the Board, Management has performed additional analysis and assessment of the cost to establish a non-RF AMI option. In doing so, we produced Alternatives 1A and 1B. This is based on Alternative 1 and then adds the cost to pursue non-RF AMI options. Non-RF AMI options include what are generally called "wireline options" such as power line carrier (PLC), telephone lines or direct fiber connections. PLC is used by Lane Electric Cooperative where communication takes place over the electrical lines rather than through RF or another line such as a phone line or fiber optic cable.

PLC appears to be the least cost wireline option, but has certain technical limitations and challenges such as limited bandwidth and the ability to filter "noise" and carry signals. Fiber is by far the most robust communication option in terms of bandwidth (orders of magnitude greater potential than PLC and even RF), but is extraordinarily expensive. The bandwidth associated with fiber is likely far in excess of what is necessary for an AMI system and is, therefore, a diminishing returns challenge. From EWEB's perspective the most important implication of wireline or non-RF AMI options is that water meters cannot be included on any reasonable cost basis. Another important issue for this type of AMI is that such a system really is limited to a meter reading and start/stop system and it becomes more expensive to subsequently pursue any advanced AMI programs that would program power resource benefits such as those contemplated in Alternative 3 because of the relatively limitations of PLC over RF..

Some have suggested that PLC or fiber options are preferred to avoid the potential health concerns of RF. What Alternatives 1A and 1B show is that pursuing a non-RF option would be uneconomic to very uneconomic; therefore, Management recommends against further consideration of non-RF options. EWEB invited companies that offer PLC options to bid on our RFP and they declined to respond. EWEB performed its own estimates to add costs to implement a PLC option. A PLC AMI option is technically feasible; however, our estimate is that it would add approximately $10 to $15 million dollars in cost and would not have the range of future flexibility of RF AMI options. A fiber based AMI option is also technically feasible; however, our estimate is that it would add approximately, $30 to $50 million to run fiber to every customer location. A telephone line based system is also technically feasible and our estimate is that it would fall in between a PLC and fiber-based solution.

A summary of the Base Case, Alternative 1, 1A and 1B is shown in Figure 3-1.

Figure 3-1: Non-RF Based AMI Options Compared to Base Case and RF-Based solution.



Despite some suggestions that non-RF technologies would be a preferable solution offering the same benefits at perhaps less cost, based on hard data and analysis, Management concludes that there is no basis for this conclusion. A detailed review of our own RFP and review of multiple AMI deployments does not support anywhere near a $500 per meter estimate for AMI nor does it show that non-RF solutions are more economic than RF solutions. In fact, analysis shows that PLC and fiber AMI options are more expensive.

As shows in the table above, non-RF AMI options range from uneconomic to grossly uneconomic. Management bases this conclusion on hard data and facts and would therefore not recommend a PLC or fiber-based solution. If potential health concerns associated with RF are the driver for seeking alternative AMI technologies, Management believes that a more effective method to address these concerns would be to develop an "opt-out" option and to mitigate total RF through the AMI system design and configuration, or to stay with the Base Case.

Appendix 4 "AMI Light" Option:

Another possible option that has been suggested and requested for consideration by the Board is what Management calls the "AMI Light" option. The basic concept with this option is to develop a cheaper AMI system that perhaps relies on less technology. Rather than something like Alternative 3 that uses a "high tech" or an advanced AMI system that can communicate with devices in the customer home and perhaps manage customer devices like thermostats and water heaters the "AMI light" option might use non-communicating digital meters that could still record hourly use (but not communicate that information in real time) and instead rely on customer installed devices such as simple timers on appliances such as water heaters or other appliances. Such an option is conceptually feasible, but it raises fundamental questions about whether customers are willing to regularly "manage" lower tech devices like timers and whether such an approach has any value to a utility in terms of system or power resource management.

For purposes of this possible future world, Management considered a future where we continue to see more dependence on variable resources like wind and solar and that we continue to lose flexibility with hydroelectric generation due to issues like environmental concerns. This is exactly the same world we assumed in the Base Case and Alternatives 1, 2 and 3. We also assumed a possible future where Time-of-Use rates emerge. In this future world an "AMI Light" option might be similar to Alternative 1 in that it would enable TOU rates like Alternatives 1, 2 or 3. Digital non-communicating meters are less expensive than AMI meters (but not by that much), but they do not have the other potential benefits of AMI meters (e.g. remote start/stop service). In concept, the "AMI Light" option would be to try and create some of the benefits of Alternative 3 without the added cost of the higher tech Alternative 3. "AMI Light" is probably a hybrid of the Base Case, Alternative 1 and Alternative 3 with the general hope that you can get the benefits of Alternative 3 (highest benefits) without the higher investment. Unfortunately, this does not appear to be realistic.

While conceptually an interesting option, Management does not believe it is practically feasible or realistic. First, we found no evidence of other utilities pursuing this option. In reality, this option could have been implemented well before AMI was even conceived of as a technology option. In order to incent customers to shift consumption on a sustained basis, Management believes that a long-term price signal or some other economic incentive (or disincentive) is necessary. Certainly, in a serious crisis or emergency like the energy crisis direct appeals to customers to reduce or shift demand will result in short-term responses. However, these are not sustainable results. Eventually, the crisis or emergency subsides and customers resume their normal consumption patterns. The only sustained way to create long-term changes in consumption is through clear longer-term economic signals. Low tech solutions such as customer installed timers on devices like water heaters or EV charging stations may shift the demand in response to price signals, but that is only part of the solution.

The other main advantage of the higher tech AMI solutions is that the customers and utility can form a different relationship where certain customer loads can be directly managed by the utility. This direct management allows a utility to treat customer loads similar to generation plants (one can think of it as "negative generation"). High tech storage water heaters and EV charging stations where a utility could assure a customer that his/her hot water was available every

morning when they wake up and that their EV is fully charged and ready to go is part of the Alternative 3 vision. Certainly, a lower tech solution like putting water heaters and EV charging stations on timers is potentially less expensive than Alternative 3 options, but it also does not have nearly the same value to the utility in terms of resource benefits. In fact, it could have negative consequences.

The main reason for this is that low tech solutions like timers require customer intervention and correction (e.g. resetting after a power outage or adjustments to daylight savings, etc.) and the solutions are not dynamic. In reality, utility peaks do not occur at the same time every day and in fact vary significantly. Low-tech solutions like timers are not flexible enough to respond to utility needs that are very dynamic. Even during a single week utility loads can vary greatly in terms of magnitude and time of peak. Low tech solutions that require manual intervention cannot keep pace with this kind of dynamic environment. Add to this challenge the concept of wind power changing every few minutes all day long and low tech solutions like timers simply cannot keep up with a dynamic environment.

In some case, timers could make things much worse in terms of grid management. The higher tech solutions envisioned by Alternative 3 would allow EWEB and customers to partner on a dynamic basis that meets both customer needs and utility needs. Management does not believe it is realistic to assume that customers would be willing to regularly reset and adjust low-tech solutions to meet utility needs. An advanced AMI system would enable automation of these functions.

In conclusion, Management does not believe “AMI light” is a practical option compared to Alternative 1, 2 or 3 in particular. It is an option relative to the Base Case and we believe it is certainly less expensive than Alternative 3, but it also would not create the benefits of Alternative 3 either. If “AMI Light” was a clear alternative it would have been developed and pursued many years ago by the utility industry. Fundamentally, it likely falls short because we do not believe customers are willing to participate on a hour-to-hour basis with their utility which would be what is required for the utility to find power resource benefits associated with management of customer loads.

Appendix 5 Risks and Public Considerations and Concerns:

Project Risks:

Specific risks such as security issues are discussed in the sections following General Risks. The most significant general risks are: (i) project implementation risks, (ii) technology or material defect risks and (iii) failure to achieve benefits risk. These risks are addressed below.

General Risk: Project Implementation Risk:

The primary project implementation risks are failure to control cost, deliver scope or meet schedule. These risks are mitigated through a variety of means such as following standard project management practices with qualified personnel, appropriate management oversight and check-in, contract and vendor management and most importantly a well thought out upfront plan and scope. Management does not believe any of these risks are show stoppers and we have sufficient expertise to manage these risks effectively including, but not limited to, experienced project managers and management, adequate controls and reporting and new business management systems that will be in place in advance of an AMI project.

General Risk: Technology and Material/Manufacturing Defect Risk:

The primary risks here are new technology and material defect risks. Purchasing “serial 1” of any new product is a general risk. AMI technology is now well in to 5 plus years of development and implementation. In many cases, vendors are now on versions 2, 3 and 4 of their product so many “serial 1” risks are no longer present. AMI technology and nearly every vendor has been through a variety of vendor and customer testing and pilots so the technology is well understood at this point and numerous lab and field tests have been performed and full scale implementations have taken place. We do not expect fundamental technology risks to be an issue. Nonetheless, technology risks are mitigated through a variety of contractual means such as acceptance testing and criteria and payment terms and conditions.

Material and manufacturing defect risks are always an issue with any long-lived product whether old or new technology. Early AMI adopters did extensive reviews and work on vendor quality control. By moving later, EWEB automatically gets the benefit of this early work performed by and paid for by others (vendors and early AMI customers). The other form of mitigation of this risk is to have excellent warranty terms and conditions. EWEB is already working on this as a primary contractual issue to mitigate material and manufacturing risk.

General Risk: Failure to Achieve Benefits Risk:

Even if a project is delivered on time and on budget and meets all scope requirements another form of risk is that benefits do not meet expectations. This can occur either due to overestimation of benefits in the original business case or failure to realize benefits during and after implementation. The primary method used to mitigate the overestimation of benefits risk is to build a reasonably conservative business case and to include contingencies in the cost estimates. While many costs such as meters can be pinned down with a high degree of certainty

other costs and benefits are less certain. This is best demonstrated in Alternative 3 where the future power market and potential customer participation rates indicate a fairly wide range of potential benefits.

Our range includes expected, optimistic and pessimistic views of the future for these benefits. In order to test how comfortable (or not) we are with a particular option, we can and have included more contingencies on the cost side and assume a more pessimistic view of benefits. Business cases that still show a positive economic case even under more adverse assumptions are more insulated to risk. Another important point regarding Alternative 3 is that if benefits do not materialize as expected the long-term programs can be eliminated. In-other-words, Alternative 3 is not a "big bet." There are some upfront investments such as the HAN and MDM, but Management believes that option value alone makes it prudent to make these initial investments.

All projects like AMI that are in part driven by technology for labor efficiency and must realize the benefits by labor reductions. EWEB's business case for AMI relies, in part; on labor cost reductions (e.g. meter reading). When AMI is fully in place, EWEB must reduce the number of meter readers it employs otherwise it will not realize benefits. As we have discussed openly and publicly, we don't see AMI as a "pink slip" program. However, EWEB is not in the business of employing 550 people as a core business. Our core business is to deliver water and power on a reliable and affordable basis.

For some time now, we have been cross-training meter readers and backfilling with limited duration meter readers in anticipation of a possible AMI system. Given expected attrition in general for other jobs at EWEB, we expect (and have already seen) some meter readers move to either temporary or regular new positions. Cross training and learning new skills is a mutual obligation of both management and employees and is one that has been underway for a number of years.

We fully expect that the labor reductions estimated in this business case will be realized and that they will occur in a manner that gives employees a reasonable chance to pursue a new job at EWEB in a position that is actually needed and not invented. We anticipate that some people will retire, some will change jobs and some limited duration employees hired with that clear understanding will have their jobs end. It is entirely possible that some regular meter reading employees will not be employed after implementation of AMI. In all cases, Management is committed to realizing the operational savings estimated in this business case to work proactively and productively with employees during an AMI transition.

The following sections address a variety of risks and public considerations and concerns that have been raised.

Security Concerns and Risk:

There are two basic security concerns associated with AMI meters. The first has more to do with customer usage data. The general concern relates to customer usage data being hacked or stolen. Customer data such as names, addresses, SSN, are not stored on AMI meters, but in "back office" systems at the utility just like they are today. AMI usage data is certainly more detailed

than data associated with traditional analog meters. Data is stored (subject to certain memory limits) locally in AMI meters and it is periodically transmitted via the AMI communications network and stored (in various forms) in utility back office systems. Stealing of "usage data" raises some concerns, but it is difficult to assess what this risk is relative to the risk of the current system.

Anyone can walk up to a meter (analog or AMI) and "steal" customer data today. An AMI meter could actually be more secure in that respect if the display is turned off. Security was one of the top concerns even among pilot participants, and having your personal information intercepted when sent wirelessly, or otherwise hacked is something that a lot of people worry about or have actual experience with. Usage data and personal customer data all need high levels of protection. Usage data is transmitted via RF and AMI meters and networks are designed with security in mind. Customer specific personal data is stored on back office systems much like it is today. Security is equally important for these systems even if the data is not transmitted by RF. This is an existing exposure unrelated to AMI and is managed by a combination of business practices, technology and policies.

Relative to stealing customer usage data an AMI network could be "hacked" to steal customer usage data as can the back office systems. Likewise, someone could steal a device used to read non-AMI meters today (typically a handheld unit) or similarly hack in to the utility back office systems. Ultimately, customer usage data may be more secure on a modern AMI system than an older system that was not designed with the security standards that AMI systems are designed to meet. A more practical issue really is; what would someone with bad intent be able to do if they acquired customer usage data?

A theoretical concern is that someone could hack the customer usage data remotely and then assess whether someone was home or not. While this perhaps is a theoretical concern it really is not a practical concern in our judgment. Businesses and homes consume different patterns of electricity whether the home or business is occupied or not. A potential thief with the intent of robbing a home or business has much easier and low tech ways to "case a home or business" and Management does not believe hacking in to AMI usage data would be an effective tool for "casing homes." Walking up to an existing analog meter and seeing the spinning wheel (or non-spinning) probably provides more information than looking at an AMI meter display or hacking AMI usage data.

The other more significant security concern for AMI meters is that certain types of AMI systems not only can read data, but also control the electric meters (e.g. turn them on and off). This potential issue and concern was recognized very early on in the development of AMI systems and requirements, Early AMI adopters required that manufacturers develop very high levels or security built in to the AMI meters and the system management tools. This included standard security approaches such as encryption, system key management and other security approaches. Many vendors adopted very high level security approaches including models based on Department of Defense standards. While no system is completely foolproof Management believes that appropriate levels of security have been recognized and are being refined over time to mitigate potential security risks. Additionally, security continues to improve with new standards and advances in AMI meters. AMI meter manufacturers and utilities continue to

make additional security improvements. Finally, AMI meters have many security features that traditional analog meters have absolutely no capability for. An example of this is that AMI meters can self-report tampering where analog meters cannot.

<u>Privacy Concerns and “Big Brother” Concerns:</u>

Another basic issue that has surfaced relative to AMI meters is the issue of privacy. While YouTube videos of people expressing concern about their utility or “big brother” watching their specific electrical use are perhaps entertaining, they don’t have any real basis in practical reality. Some claims are that the utility will watch you when you use your electric toothbrush or open your refrigerator. An AMI meter alone cannot determine what equipment, appliance or device a customer is actually using behind the meter. The meter can tell usage at a higher frequency, but cannot distinguish between equipment and appliances. In order to determine actual individual electrical uses in a home, there would have to be monitoring and metering down to the circuit and device level in addition to massive and not to mention completely unnecessary and wasteful technology investments.

It is theoretically possible that someone could develop detailed analytical tools to create pattern templates and profiles of electrical usage and then compare that against AMI meter data to assess what a customer is doing in his/her home at any given moment. While maybe interesting for a YouTube video, the reality is that utilities don’t really have any business need or interest in such use and no utility would rationally want to go to the expense of building the analytical tools and communication network or adopt meter specifications to actually do this.

For example, it would require second-by-second meter monitoring and very high bandwidth communication and ultimately massive amounts of data storage. Utilities are going to be challenged enough trying to store hourly or 15 minute data. It would be a total waste of time and effort and serve absolutely no purpose to build meters, communications networks and back office systems to be able to monitor second-by-second customer consumption for purposes of telling when someone is using an electric toothbrush for example.

As a Water Utility that provides non-fluoridated water we perhaps care that our customers brush their teeth, but don’t really care when they brush their teeth or whether they use an electric toothbrush or manual one or what kind of toothpaste they use. The future envisioned by Alternative 3 concept is one where the utility and customers work in partnership to help the utility manage the utility system. As discussed the “Opt-in & Opt—out” section of this business case, Management assumes that these programs and options would be voluntary. We envision that customers would opt-in to programs like EV charging controls. Management already can recommend against any program that controls or monitors an electric toothbrush.

To keep the privacy issue in perspective, what AMI meters are able to determine about actual customer behavior and use behind the meter (in the privacy of their home) is next to nothing. Once could surmise that a large increase in usage indicated that a large appliance just turned on, like an air conditioning unit, heater or hot tub, but with total usage data being collected, there is no way to determine what the large increase was caused by. Compared to what an AMI meter can “tell” about a customer, the phone company can tell much about a customer through their

phone usage or texting use and your internet service provider can tell even more from your web surfing.

On the other hand, with in home display devices and web portals, customers can through experimentation, learn more about the energy usage of individual devices and make better choices about how frequently they use them if so inclined. Participants in the EWEB demonstration project have already reported using their display devices to make small changes that are saving them money on their bills, such as turning off some devices at night and not running other devices 24/7.

Finally, the concern of the utility cooperating with "big brother" in the form of law enforcement is another red herring. Customer data, whether collected by a traditional analog meter or a high tech AMI meter, is fundamentally used by the utility to bill customers for service. That data is considered private and is not used by the utility for other non-utility purposes. EWEB would only provide data to law enforcement upon receipt of a valid court order. This is no different than the situation today.

<u>Meter Accuracy Concerns:</u>

Similar to the privacy issue, the accuracy issue is also presented up as another AMI issue or concern. Certainly, there have been legitimate cases of meter inaccuracy just like we have problems occasionally with analog meters today. Sometimes those are manufacturing defects with the meters themselves, but more often than that errors are caused by procedural errors (human errors most typically) and not actual meter errors. Even today with traditional analog meters, EWEB occasionally misreads a meter or enters an incorrect multiplier in to an account upon meter change outs. Management has reviewed many cases around meter accuracy issues and we have confirmed that AMI meters are as or more accurate than traditional meters.

In addition to errors and mis-reads caused by procedural errors, other major contributing factor to the perception that AMI meters are inaccurate have been: (i) installation of AMI meters right after a low consumption month going in to a high consumption month where the increase in consumption was driven by weather but attributed to the new AMI meter and (ii) installation of an accurate AMI meter that replaces a traditional meter that was inaccurate and in some cases was grossly under reading actual consumption.

While Management does not believe that AMI meters pose an accuracy issue, we fully expect that we will experience some procedural errors and historical under reading meter situations. We are already developing implementation plans and policies to deal with these sorts of issues and to mitigate procedural errors. For example, we would plan the timing of AMI installations to avoid installations right before the winter heating season where a normal seasonal spike in consumption could be associated with the new meter rather than normal changing consumption patterns.

Potential Health Risks, RF concerns and Relative Risks:

Some customers and members in the public have raised various concerns related to the potential health impacts of RF. This is perhaps the most difficult issue to tackle in the business case. While no one in EWEB Management is a trained expert on the human health impacts of RF we have carefully evaluated a variety of papers, studies and research on this topic. Perhaps the best assessment we can make is to look to the studies evaluated by the World Health Organization and other credible organizations and the regulatory standards developed for RF exposure both in the U.S. and in other countries. For several months, the Board has received a variety of input from members of the community and customers. Management is neither repeating, discounting nor ignoring this information.

While few scientific studies have specifically focused on digital meters, the available studies come to the same conclusions as the many peer-reviewed studies of similar technologies using radio frequencies (low-level wireless): no adverse health impacts.
Although there is anecdotal information that some individuals may be hypersensitive to radio frequencies, there is no definitive evidence linking such symptoms to low-level wireless transmissions like those associated with smart meters. This includes the "non-thermal" effects that some people claim are harmful.

An example of one such source that Management reviewed is Health Canada, that nation's federal health agency, which concluded that there is "no scientific evidence that the symptoms attributed to (electromagnetic hypersensitivity) are indeed caused by exposure" to such frequencies. Canada has done extensive research into advanced meters. Health Canada has concluded that exposure to RF energy from smart meters does not pose a public health risk. Management does not believe that Health Canada is a smart meter advocacy group; therefore, we put weight on findings from organizations such as this.

Another area Management reviewed was the World Health Organization. WHO concludes: "There is no convincing scientific evidence that the weak RF (radio frequency) signals from base stations and wireless networks cause adverse health effects." And this: "In the area of biological effects and medical applications of non-ionizing radiation, approximately 25,000 articles have been published over the past 30 years. Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals."

Some members of the public have raised an issue with RF being listed as a class 2B possibly carcinogenic by WHO/IARC. Management has reviewed these findings. This category is used when a causal association is considered credible, but when chance, bias, or confounding evidence cannot be ruled out with reasonable confidence. Of note, class 2B includes items that humans are exposed to on a regular basis such as coffee and auto exhaust. The report focused on RF from wireless mobile phone in particular and researchers found there was no consistent trend of increasing risk of cancer (i.e. glioma) with greater duration of cell phone use. While RF AMI meters and mobile phones use similar (and sometimes identical) RF frequencies the exposure to RF from an AMI meter is expected to be far less than other typical RF exposures. Relative to

other class 2B items (e.g. coffee and auto exhaust), Management concludes that actual relative exposure depends on personal choices and general environment.

Another concern raised is Electromagnetic Hyper Sensitivity.

Management reviewed numerous reports with respect to EHS and in particular findings by the WHO which concluded the following:

> *A number of studies have been conducted where EHS individuals were exposed to EMF similar to those that they attributed to the cause of their symptoms. The aim was to elicit symptoms under controlled laboratory conditions.*
>
> *The majority of studies indicate that EHS individuals cannot detect EMF exposure any more accurately than non-EHS individuals. Well controlled and conducted double-blind studies have shown that symptoms were not correlated with EMF exposure.*
>
> *It has been suggested that symptoms experienced by some EHS individuals might arise from environmental factors unrelated to EMF. Examples may include "flicker" from fluorescent lights, glare and other visual problems with VDUs, and poor ergonomic design of computer workstations. Other factors that may play a role include poor indoor air quality or stress in the workplace or living environment.*
>
> *There are also some indications that these symptoms may be due to pre-existing psychiatric conditions as well as stress reactions as a result of worrying about EMF health effects, rather than the EMF exposure itself.*
>
> *EHS is characterized by a variety of non-specific symptoms that differ from individual to individual. The symptoms are certainly real and can vary widely in their severity. Whatever its cause, EHS can be a disabling problem for the affected individual. EHS has no clear diagnostic criteria and there is no scientific basis to link EHS symptoms to EMF exposure. Further, EHS is not a medical diagnosis, nor is it clear that it represents a single medical problem*

Management also reviewed the California Council on Science and Technology report that was specifically commissioned to evaluation smart meters. The CCST conclusions were: "To date, scientific studies have not identified or confirmed negative health effects from potential non-thermal impacts of RF emissions such as those produced by existing common household electronic devices and smart meters"

Canada Centres for Disease Control found that: "Smart Meters emit RF radiation, but only intermittently, and at a level several times below that of the highest level of personal exposures from cell phones, and well below existing limits for RF exposure to the public" How low? The British Columbia Ministry of Health says that at 10 feet from the meter, "the radio frequency signal drops to less than 0.001 percent of the Health Canada exposure limits"

The Maine Centers for Disease Control and Prevention panel concluded that:

(1) Our review of these national and international government or government affiliated assessments indicate a broad consensus that studies to date give no consistent or convincing evidence of a causal relation between RF exposure in the range of frequencies and power used by smart meters and adverse health effects.

(2) We found little information in these assessments that spoke directly about the safety of RF exposure from smart meters. There is, however, much discussion about the safety of mobile phones. Mobile phone use represents an RF exposure qualitatively similar to smart meters in range of frequency, but because the power is higher and typical use results in exposure closer to the body, the resulting exposure to RF appears to be quantitatively much greater than that from smart meters. Thus, it appears to us that the lack of any consistent and convincing evidence of a causal relation between RF exposure from mobile phones and adverse health effects would indicate even less concern for potential health effects from use of smart meters.

RF exposure limits have also been regulated for many years in the United States and other countries. AMI meters must conform to all applicable regulatory requirements. In the U.S. the FCC is a primary regulator of RF. One main regulatory requirement for RF exposure is the Maximum Permitted Exposure (MPE) for RF as measured in uW/cm2. The FCC's MPE limits vary by the frequency of RF. Many AMI meters (from meter to collectors) us the 900 MHz RF spectrum. This is similar to many mobile phones. Some AMI meters with Home Area Networks (HAN or meter to devices in home)) use a 2.4GHz RF spectrum. This is similar to other in home devices like wireless routers and cordless phones. Even assuming 100% duty cycles (always on) the RF from an AMI meter is far less than the FCC limit. Assuming the more likely duty cycles of seconds per day the RF exposure is expected to be almost inconsequential compared to FCC limits. It is important to understand that the FCC MPE limits also built in factors of safety that established limits that are many times more stringent than the levels where measurable effects can even be established. These "measurable effects" are not necessarily established as harmful, but simply a point where an effect can even be measured.

A very recent report reviewed by Management was produced by the State of Vermont Department of Health. That report states several things such as:

(1) In January 2012, the Vermont Department of Health made actual measurements at active smart meters installed by Green Mountain Power in Colchester. The readings from these devices verify that they emit no more than a small fraction of the RFR emitted from a wireless phone, even at very close proximity to the meter, and are well below regulatory limits set by the Federal Communications Commission (FCC).,

(2) After extensive review of the scientific literature available to date and current FCC regulatory health protection standards, we agree with the opinion of experts: (i) the thermal health effects of RFR are well understood, and are the current basis for regulatory exposure limits. These limits are sufficient to prevent thermal health effects.

(ii) Non-thermal health effects have been widely studied, but are still theoretical and have not been recognized by experts as a basis for changing regulatory exposure limits. The Vermont Department of Health has concluded that the current regulatory standards for RFR from smart meters are sufficient to protect public health.

Management's position is that while there are some concerns about RF there are no definitive conclusions that it is a significant human health concern and that regulations are in place for human exposure that are set by using the best available data, analysis and studies. Even using unlikely worst-case assumptions, studies show that RF emissions are well within regulatory limits that also have built in factors of safety. It is important to note that AMI meters must meet regulatory standards for RF exposure. In conclusion and in contrast to claims that AMI meters are a significant source of RF exposure, our assessment is that AMI meters (and in particular the technology and architecture currently under consideration by EWEB) will be almost inconsequential compared to other existing RF exposure sources and only a fraction of regulatory limits.

Management recognizes that several members of the community and others have cited sources claiming that smart meters and/or RF are a material health concern or issue. Management has reviewed these and other reports, sources and documents making these claims. No one at EWEB is a health expect or researcher on RF and human health. We can only review and interpret what we have reviewed and make conclusions and recommendations. Management concludes that the findings of primary governmental regulatory and health agencies such as those listed in this business case have considered a variety of sources of information in arriving at their respective conclusions and setting regulatory standards for RF. Management concludes that health agencies and regulatory bodies are in a much better position to make these determinations and have made such determinations about the health and safety issues surrounding RF and RF devices.

RF exposure is mainly a function of time, magnitude (power) and distance. The magnitude of RF emission is set by regulatory standards. Time is a function of how often an RF device is on or off. Distance is self-explanatory. It is important to consider that RF intensity falls off based on the inverse square of the distance meaning that RF falls off extremely rapidly as you move away from a RF device. A study performed by the CCST regarding smart meters assumed very conservative assumptions and the general conclusion was that smart meters created exposure similar to many household devices. The CCST assumptions (meters on 50% of the time emitting RF and a distance of only 3 feet) are extremely conservative and substantially overstate the RF exposure an EWEB AMI meter system might create for customers.

EWEB estimates that AMI meters (based on the technology currently being considered by EWEB and likely configuration) will only communicate for seconds per day rather than the 43,200 seconds assumed in the CCST report and it is highly unlikely that a person would regularly be within 3 feet of an AMI meter. Compared to the RF exposure due to smart meters assumed in the CCST study, we estimate that the more likely RF exposure due to an EWEB AMI meter would be significantly smaller than the amount of RF exposure assumed in the CCST report. Of course, most people are rarely next to their electric or water meter. Based on the more likely proximity of people to AMI meters and the inverse square rule, Management

believes that the CCST study substantially overstates AMI meter exposure. Even with these very conservative assumptions the predicted RF exposure is similar to other existing RF exposures. Adjusting for likely duty cycle time (seconds vs. 43,200 seconds per day and likely proximity, Management concludes that AMI meters are unlikely to be even a minor source of RF exposure when compared to existing sources or even background levels of RF. This is consistent with the conclusions drawn in the studies and reports reference above.

An additional concern regarding AMI meter RF exposure is the cumulative effect. EWEB has not found any conclusive evidence that cumulative exposure is a health concern or major risk factor. However, we also note that the addition of RF exposure due to AMI meters at any given residence or location will be very difficult to even measure due to the ubiquitous nature of RF emitting devices in the environment. Our general goal is to educate customer as the relative amount of RF that is posed by AMI meters compared to other sources and devices so that customers can make informed choices that could have greater impact (like moving a router out of a bedroom, or not using a baby monitor next to a crib). Ultimately, there may be individual customers who believe that any RF exposure due to AMI meters is unacceptable. Management recommends that EWEB deal directly with this concern by providing an “opt-out” option.

Some customers may still express concern over meters in their general area, but not on their own home. Due to the inverse square principle of how the intensity of RF falls off with the square of the distance from a RF source, Management does not believe it is necessary or prudent to allow one customer to force another to opt out because of concerns that not supported in the generally accepted medical, scientific and regulatory assessments.

As a matter of final qualitative consideration of the possible health effects due to RF, Management did additional reviews to attempt to discover if there were any credible studies showing any health effect caused by long-term RF exposure in relatively high dosages (e.g. exposures much greater than an AMI meter). Examples of humans who have been exposed to relatively high amounts of RF (or extremely high compared to AMI meters) are military personnel, radio operators, pilots, police officers, firefighters, utility workers, railroad personnel, taxi drivers, public safety personnel, telecommunications workers, dispatchers and similar kinds of people who have regularly used radios for decades. Many of these radios and telecommunication devices have even higher power RF than mobile telephones that have been around for less time and yet no conclusive evidence was found that indicates that this higher magnitude RF exposure has created adverse health impacts.

Another perspective to take is to consider relative risk. In contrast to relative risk, there are some proponents of taking an absolute view of risk. One concept advanced by the proponents of an absolute view of risk is the so-called “precautionary principle.” In a nutshell, application of this principle is that an action should not be taken unless it can absolutely be proved by scientific consensus that the action is not harmful. This is a concept of viewing risk on an absolute basis rather than relative basis.

EWEB likely would not be able to deliver power or water to customers if we assessed the delivery of power or water using the precautionary principle. For example, the delivery of power via our current method (generation, transmission and distribution wires) has risk. It is an

absolute fact that people have been killed by electrical power systems. On an absolute basis using the precautionary principle, EWEB should not deliver power to customers because there is a risk associated with delivery of that power. However, a relative view of risk would assess potential risks against known benefits compared to alternatives. In this way, one could look at the customer/social, environmental and economic potential benefits and weight those against the risks, similar to a Triple Bottom Line assessment, as a more realistic and prudent way for make a complex decision like AMI. Management does not believe application of the precautionary principle for making this decision is appropriate.

AMI meters and smart grid have the potential to transform how we consume and manage power. There is fairly general scientific consensus that moving away from fossil fuels to reduce greenhouse emissions is important to our planet. Moving away from fossil fuels means moving toward more renewable resources like solar and wind that is more variable in nature. We also need to be prepared to integrate both central and distributed generation resources and new storage technologies. In order for utilities to be able to do this we need to transform our 20th century utility model into a 21st century model. AMI is part of this transformation. In examining the risks associated with AMI meters, we need to assess those risks against the risk of staying with our 20th century model. Some people may claim that we don't need to modernize our metering and grid system in order to achieve this transformation. Management has not yet found a credible source or party that has made this claim that has actual experience operating an electrical power system.

Ultimately, this decision comes down to how to judge risk and how EWEB meets all customer needs. We do not expect that 89,200 EWEB electric customers and 52,600 EWEB water customers would ever reach consensus on moving forward with AMI meters or frankly any decision that the Board or Management makes on a regular basis. It is entirely possible and likely that some customers will not agree. The question for the Board and Management then becomes whether to move forward or not in the best interests of the public and the utility, and if the decision is to move forward, what reasonable mitigation can be put in place to address concerns of some customers.

Management believes that perhaps the best way to manage this tension is to provide an "opt-out" option for customers who do not wish to participate in AMI meters. It is important to note, however, that this should not allow customers to determine what meters EWEB uses to bill. For example, if EWEB moves to TOU pricing, we would need to have a TOU meter (meaning a digital meter with data storage capability). It may very well be an AMI meter with the radio turned off or a non-communicating digital meter. It would not be a traditional analog meter though.

Assuming the Board supports continued detailed planning of AMI as recommended by Management, one public education option might be for EWEB to conduct measurements similar to what the Vermont Department of Health referenced in its recent report. Management would recommend that such measurements be conducted on the actual final AMI technology EWEB might adopt perhaps in a continued or new demonstration project. EWEB has attempted to make RF measurements on the existing AMI demonstration pilot. Management does not place any weight on these results or similar results because we do not have sufficient testing equipment or

methodologies to make definitive assessments of RF from AMI meters. Management does not believe that it would find anything fundamentally different than the Vermont or other reports have found and we don't believe it would necessarily contribute to the research base or changes in conclusions or regulations. What is might provide though is useful public information and education about the actual levels of RF from actual AMI meters and whether those levels can be measured or distinguished from other background sources. Management does not recommend additional general research on the RF issue. We have no basis to conclude that such research will arrive at a different conclusion than vast body of research already performed and that has shaped existing regulatory standards for RF over many decades.

Time-of-Use (TOU) Rates and Customer Choice:

One concern that is raised about AMI meters by some customers, regulators or other advocacy groups is that AMI meters will enable TOU rates and that TOU rates are either (i) "customer unfriendly" or (ii) will hurt customers and limited income customers in particular. TOU rates do generate several important issues and those are discussed in more detail in this section. First, AMI meters are not necessary to implement TOU rates. There are existing digital meters (non-communicating) that can store hourly reads for a month. Those reads can be read via a meter reader and can already be used for TOU billing. TOU rates have been in use around the world for many years. The problem with this approach is that no "real-time" or close to "real-time" information is available to customers in this model. AMI meters could provide real-time or close to real time consumption information.

TOU rates, unlike traditional utility rates, have time differentiated costs (i.e. typically higher on-peak rates and lower off-peak rates). Herein lays the concern of some customers and regulators that customers can't change behavior or consumption patterns to avoid these higher rates. This is especially a concern if customers don't have real time information to make consumption decisions. One claim about AMI meters is that they could enable effective TOU rates which would result in customers paying more (particularly on-peak).

The problem with this view is that it is based on the completely false premise that customers don't already pay these higher on-peak costs today. In reality, customers pay these higher costs today and don't even know that they are paying them because the 20th century utility rate model actually masks the higher costs by spreading them out over all customer consumption. These costs are actually incurred by customers right now.

The wholesale power market is the most volatile commodity market on the planet. In spite of this high volatility, the utility industry has historically priced power as if it was the most stable commodity on the planet. In reality, customers pay the higher costs without even knowing it and because they don't know it they have absolutely no choice. TOU rates combined with AMI meters would give customers an actual choice whereas today they have no choice. It is the existing rate and metering model that does not provide a choice but forces customers to "blindly" pay unknown costs that is most insidious.

Ultimately, TOU rates and AMI meters could save customers money compared to what they will otherwise pay in the future. Customers who place the greatest value on saving a few dollars are

likely to be the ones most likely to shift consumption and benefit from TOU rates and AMI meters. Another argument made against TOU rates is that limited income customers may not have the money to invest in “high tech” or more efficient appliances such as water heaters and such. This is not really an AMI or TOU issue, but a different issue that is already and more effectively addressed by programs such as EWEB EMS programs that help deal with the upfront cost barrier. Management has not yet assessed whether TOU rates should or should not be pursued or whether those rates should be optional or not. Of course, rate decisions including TOU rates, are subject to Board approval. The one thing we have determined is that our current metering infrastructure cannot accommodate TOU rates. Management has concluded that TOU rates send much better short-term and long-term price signals than our current rate structure and may serve a future purpose.

Management also envisions that part of the programs that emerge under Alternative 3 will be programs that directly address how to let any customer participate in those programs and not just customers who have money to invest in technology. Similar to EWEB’s existing EMS programs, new Alternative 3 programs might be built in to rates making it easier for all customers to participate. A possible EWEB energy future is one where we can offer customers different choices rather than no choice.

Appendix 6 Other Water Utility Benefits:

Leak Detection and Troubleshooting:

One of the most frustrating issues EWEB customers can face is getting a surprise high water bill that is due to a large undetected water leak. Some water leaks (in particular underground irrigation leaks) are not obvious to customers and only are "detected" when they receive an unusually high bill. Today, when a customer calls EWEB with such an issue an EWEB employee can attempt to suggest things over the phone and sometimes a troubleshooter is dispatched to the customer location to make a physical assessment if the customer cannot find an immediate cause. Depending on the AMI system ultimately chosen and additional investments (e.g. MDM system) EWEB may be able to remotely detect or troubleshoot leaks. Depending on whether EWEB goes with Alternative 2 or 3 and possible additional investments, this is an additional customer benefit.

General Rates Structures and Emergency or Drought Rates:

EWEB water rates are going to be reviewed during 2012 for possible structural changes. The context of these changes though relates to fixed and variable costs and better aligning cost causation and rate structure. Generally speaking, the Water Utility is largely a fixed cost business and more costs should probably be recovered through fixed charges rather than volumetric charges. Indeed, some water utilities in the past only charged a flat connection fee and did not even meter water consumption. While water is largely a fixed cost business, metering and rate structures are critical. EWEB is undertaking a water rate study to evaluate rate structures that both recover fixed costs and also encourage good long-term use of water. Pricing water without a variable element could encourage wasteful water use which ultimately would result in additional water plants and even higher fixed costs. Likewise, recovering costs solely or primarily on volumetric elements risks under recovery of fixed costs. Therefore, it is a balance between fixed charges and volumetric charges to encourage reasonable water use and to recover fixed costs at the same time. AMI water meters are likely to be helpful in improving rate designs in the long term for the Water Utility.

While the Pacific Northwest typically has not experienced water shortages like California and the desert southwest, or even other parts of the country it could be increasingly possible due to possible changing weather patterns and drought periods. Some utilities around the nation have "drought rates" to encourage more conservation during water shortages. AMI meters would give EWEB more flexibility to design and quickly implement such rate structures.

Another issue EWEB faces is its lack of a second source of water. If EWEB pursues and eventually obtains a second source of water one of the major issues will be the sizing of the second source. Building a second source to meet all-time peak EWEB use would be prohibitively expensive in Management's judgment and has never been suggested. A more economically feasible option will be to size a second source to meet only basic minimum community needs. In order to insure that a smaller 2nd source is capable of serving the

community, it might make sense to have “emergency rates” similar to the concept of “drought rates.” These rates would encourage “curtailment” of consumption. AMI meters might be essential in implementing more complex rate structures and providing customers more immediate knowledge of their consumption so they can immediately change consumption in the event of an emergency or drought.

Appendix 7 TBL Assessment and Summary:

Table 7-1 below is a summary TBL (social, environmental, economic) evaluation of the major considerations related to an AMI decision. By the very nature of a TBL evaluation it is both quantitative and qualitative.

Table 7-1: AMI TBL Evaluation and Assessment (relative to do nothing/status quo):

TBL Factor	Base Case (status quo no AMI)	Alternative 1 (electric only AMI)	Alternative 2 (electric and water AMI)	Alternative 3 (electric and water AMI plus customer facing programs)
Economic (20 year net present cost to customers)	Higher long –term costs	Better than Base Case. Savings are passed on to customers.	Much better than Base Case. Savings are passed on to customers.	Best option at expected case with highest upside potential. Savings are passed on to customers.
Economic (short-term rate impacts)	N/A	Little to none, depending on financing option.	Little to none, depending on financing option.	Little to none, depending on financing option.
Social: Meter Reader layoff potential	Meter readers stay. No creation of new types of jobs linked to AMI.	Some meters stay (water). Mitigate potential impact through current cross-training, etc.	No meter readers stay. Mitigate potential impact through current cross-training, etc.	No meter readers stay. Mitigate potential impact through current cross-training, etc.
Social: Elimination/creation of "family wage jobs" in community	N/A	Loss of approximately 12 meter reading/field services jobs, but creation of 2 new jobs.	Loss of approximately 25 meter reading/field service jobs, but creation of 2 new jobs.	Loss of approximately 25 meter reading/field services jobs, but creation of 8 new jobs.
Social: Potential Human Health concerns over RF	N/A	Some significant concerns among small number of customers. Little to no concern among most	Some significant concerns among small number of customers. Little to no concern among most customers. Mitigate with customer opt-out	Some significant concerns among small number of customers. Little to no concern among most customers. Mitigate with customer opt-out option and system design to limit duration of RF exposure.

		customers. Mitigate with customer opt-out option and system design to limit duration of RF exposure. Not expected to be incrementally significant.	option and system design to limit duration of RF exposure. Not expected to be incrementally significant	Not expected to be incrementally significant
Social: Creation of Better Outage Detection and Response Time	N/A	Yes, substantially improved.	Yes, substantially improved.	Yes, substantially improved.
Social/Environmental: Ability to support IERP	N/A (none)	Very Limited	Very limited	Very strong.
Environmental: Increase ability to integrate renewable resources, avoid new plants, and better address CO2.	N/A (no help).	Very Limited.	Very Limited	Extensive help.
Social: Move toward more reliable "smart grid" to help EWEB	N/A (no help)	Very Limited	Very Limited	Serves as very solid base.
Social: Meter Reader "eyes on the street" and personal privacy issues.	N/A (no change)	Loss of eyes on the street, but no meter readers in yards, etc.	Loss of eyes on the street, but no meter readers in yards, etc.	Loss of eyes on the street, but no meter readers in yards, etc.
Environmental: Burn less gasoline reading meters.	N/A (no change)	Similar to Base Case since water meters would still need to be read.	Substantial elimination of fossil fuel burn	Substantial elimination of fossil fuel burn

Appendix 8 AMI Financing Options and Potential Rate Impacts (All else being equal*):

For purposes of explaining relative rate impacts, Management assumed that EWEB stayed with the status quo (Base Case) for comparison purposes. What this means is that EWEB would continue to replace meters (water and electric) on a fairly stable basis and meter readers would continue to read meters the way we do today. The cost of this is pretty smooth over the 20 year period, but does escalate with things like inflation. The "cost" of this approach is generally built in to rates today and just would escalate over time. However, the Base Case does assume that certain "catch up" due to deferred meter replacement that does need to take place if EWEB stays with the status quo.

Because of AMI considerations, EWEB ramped down meter replacements in recent years because it did not make sense to replace meters with old technology only to turn around and replace them again in a few years. However, this practice cannot continue indefinitely. If EWEB stays with the status quo, we will need to catch up with some deferred replacements so there could be a short-term rate impact even with the status quo. This is particularly true for the Water Utility because our average meter age is older than generally acceptable.

In contrast to the Base Case, Alternative 3 requires a larger short-term cost (the investment in the AMI system) and then benefits accrue back over the long-term mostly in the form of lower meter reading costs, start/stop service savings and power resource benefits. Over a 20 year period Alternative 3 is much better than the Base Case or the other 2 alternatives. However, over a very short-term (e.g. 1 to 3 years) the cash flow cost is actually higher (as the AMI system is built). The source of money used to pay for AMI can have different short-term and long-term rate impacts.

This Appendix 8 is a summary of the potential immediate short-term and long-term rate impacts of Alternative 3 compared to the Base Case using different assumptions about how AMI is financed. AMI could be financed using at least 3 different methods or some combination of 3 different methods including: (i) cash in the form of current excess reserves, (ii) new debt/Bonds and/or (iii) revenues generated by immediate short-term rate increases to pay for AMI that are then lowed later as the benefits of AMI accrue.

Management considers AMI a combination of "Type 3" and some "Type 2" capital investment that is both strategic and long-term. Therefore, it does not make general business sense to raise short-term rates for a long-term project that creates long-term benefits. Today's customers would essentially be paying for benefits received by later customers. Management believes that some combination of the first two sources of funds (cash from excess reserves and/or new debt/bonds) makes the most sense. Management believes that on-going AMI costs would be paid for in rates just like EWEB pays for meter reading costs today in rates.

In light of the upcoming and planned Carmen-Smith relicensing which is expected to be approximately $150 million for a license and plant that is expected to have a life of at least 50 years, Management recommends against using large amounts of additional debt at this time.

EWEB's current financial situation and financial ratios indicate that it would be better to use current excess reserves to fund AMI, at least in substantial part. As shown in this Appendix 8 this approach has limited or no short-term rate impact. This approach best lines up costs and benefits over time to the overall benefit of customers today and tomorrow.

It is very important to note that the rate impact analysis contained in this Appendix is an "all else being equal" analysis meaning that everything else is assumed to not change. Of course, we already know that rates are forecast to increase regardless of AMI. It is important to recognize that when and if rates go up in future years it is not due to AMI, but to other factors such as BPA rate increases, Carmen-Smith, general infrastructure and system replacement, power costs, labor costs and such. The "all else being equal" analysis was necessary to show the AMI impact on its own.

Table 8-1 Rate Impacts (total Electric and Water) compared to Base Case.* **

	Alternative 3 Financed 100% with excess cash reserves	**Alternative 3 Financed with excess cash reserves and new debt**	**Alternative 3 Financed 100% with new debt**	**Alternative 3 Financed 100% with short-term (5 year rate increase)**
Short-term rate impact (0 to 5 years)	Possible slight decrease	No change to possible slight increase or decrease depending on relative mix of excess reserves and new debt used	Slight increase until benefits stream offsets debt payments.	Moderate increase in short-term rates to fund AMI project costs.
Longer-term rate impact (6 to 20 years)	Slight decrease as benefits stream increases.	Slight decrease as benefits stream increases and exceeds debt payments	Slight decrease as benefits stream increases and exceeds debt payment	Moderate decrease as benefits stream increase and 5 year rate increase is ended.
Over 20 year life compared to Base Case	Better than Base Case	Better than Base Case	Better than Base Case	Better than Base Case

* Note 1: The rate impacts listed in the table above are based on an "all else being equal" analysis. EWEB forecasts that rate increases (and sometimes decreases) will occur normally due to other factors such as BPA rate increases/decreases, power costs, general inflation, infrastructure replacement and labor costs. These rate impacts are estimated based solely on the approximate AMI project costs, financing options and how benefits are accrued over time.

** Note 2: The rate impacts listed in the table above reflect a net of the Electric and Water utilities. The Water Utility has no reserves to fund AMI. The Electric Utility may be able to fund portions of the Water Utility with reserves; however, the Water Utility would have to pay the Electric Utility. It is possible that the individual utility results could be a decrease for Electric and an increase for Water with the net being a decrease. The specific utility impacts will depend on final cost and financing decisions. The basic conclusion that combined customers are better off still holds over the 20 year period.